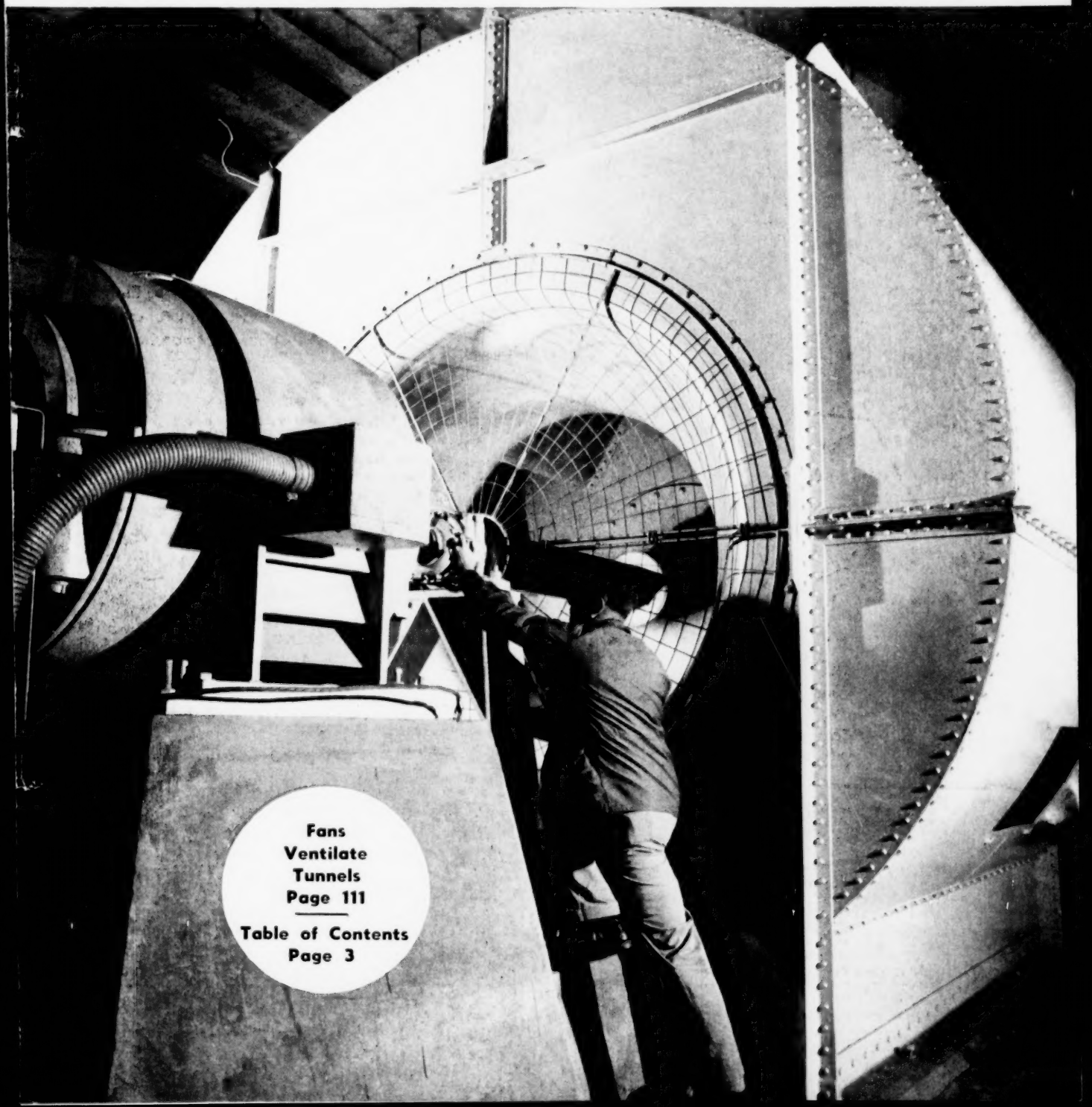
SEPTEMBER, 1953

HEATING AND VENTILATING

INCLUDING AIR CONDITIONING – PIPING – REFRIGERATION – AIR SANITATION



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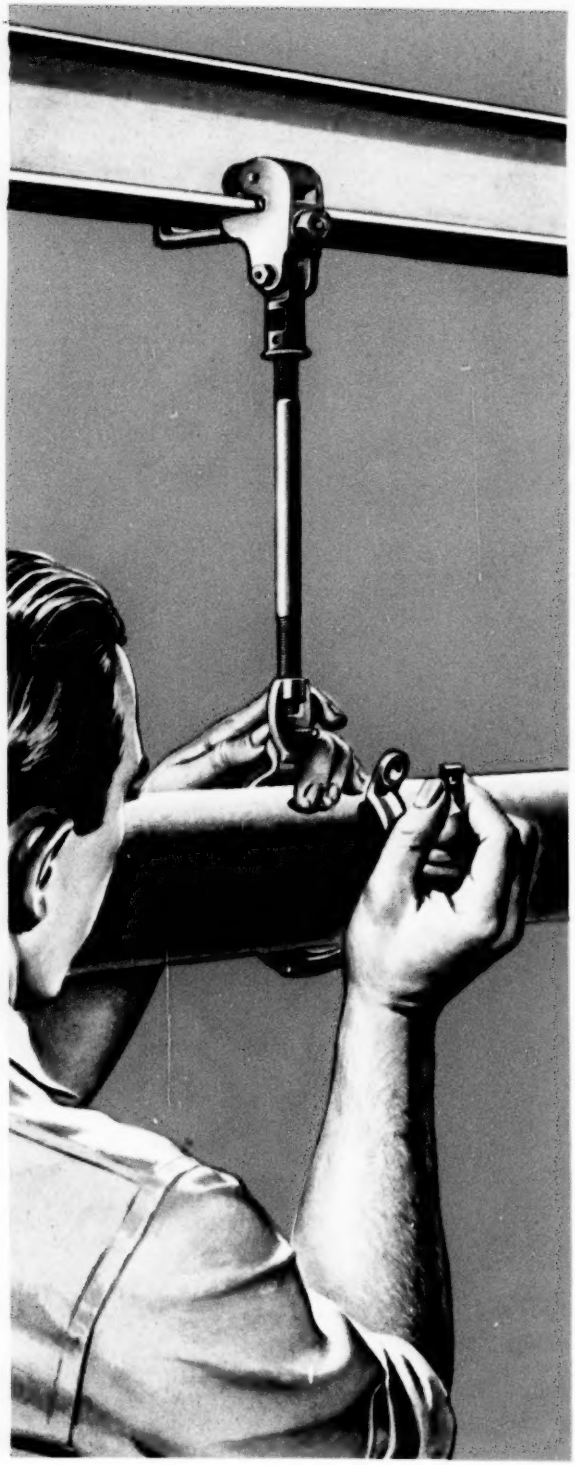

Right for the job and priced right!

There's nothing sensationally "tricky" about this pipe hanger. It's just the most practical and inexpensive way of hanging pipe for a great many jobs. Complete assembly includes a split pipe ring and socket, rod, extension piece and universal I-beam clamp. Available for pipe from ½" to 8", for loads from 75 to 1510 lbs.

It is well worth remembering that a good piping job is too important to jeopardize with improvised or inadequate pipe hangers and supports. You can get from Grinnell just the right pipe hanger for any job within the shortest possible time at the lowest cost consistent with quality.

Grinnell has the most complete line of pipe hangers, extensive manufacturing facilities, warehouses across the country, and jobbers in almost every city and town.

UNIVERSAL SIDE I-BEAM MALLEABLE IRON CLAMP (Fig. 225) . . . Used on American Standard I-beams as well as wide flange beam sections. One of 14 different Grinnell beam clamps to meet varying specifications.

MALLEABLE IRON EXTENSION PIECE (Fig. 157) . . . Bolts into Universal Side I-beam Clamp (Fig. 225) and other malleable iron clamps to receive hanger rod. Provides for adjustment of rod.

MALLEABLE IRON SPLIT PIPE RING AND SOCKET (Fig. 107R) . . . Once hanger rod is turned to proper adjustment and the attached half of the ring is snugged against the pipe, the other half of the ring is swung up into position and bolted. For 13 pipe sizes, ½" to 8", for loads from 75 to 1510 lbs.

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WHENEVER PIPING IS INVOLVED

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

Manufacturer of: pipe fittings • welding fittings • forged steel flanges • steel nipples • engineered pipe hangers and supports
Thermolier unit heaters • Grinnell-Saunders diaphragm valves • prefabricated piping • Grinnell automatic fire protection systems

LIFE INSURANCE ON 10,000 ORCHIDS

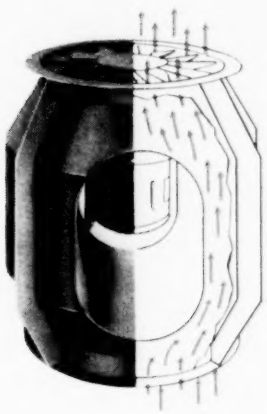
Orchid grower Walton Riffe, owner of Walton's Greenhouse, Dayton, Ohio, with some of his rare specimens. The two DeBothezat Induced Draft Bifurcator Fans in the background are mounted in the boiler breeching. Each fan serves two boilers.

A sudden drop in temperature can put an orchid grower out of business overnight. That's why Walton Riffe installed an automatic heating plant, complete with stand-by boilers, in his greenhouses.

To be sure of adequate boiler draft at all times, this famous grower mounted two DeBothezat Induced Draft Bifurcator Fans in the breeching. Now, Mr. Riffe doesn't worry. Dependable DeBothezat Induced Draft Bifurcator Fans produce a positive controlled draft that helps his system to maintain tropical temperatures regardless of weather.

Remember DeBothezat Induced Draft Bifurcator Fans the next time you have a stack problem. These fans provide a constant, controlled draft for boilers and furnaces at all times. They permit boilers to operate at maximum efficiency under any load, regardless of weather. And the cost of an Induced Draft Bifurcator Fan is usually only a fraction of the cost of erecting an old-fashioned brick or steel stack.

Ask your DeBothezat representative — you'll find him listed in the phone book under "Ventilating Equipment" — or write our factory, Dept. HV-953, for illustrated catalog HV-953.

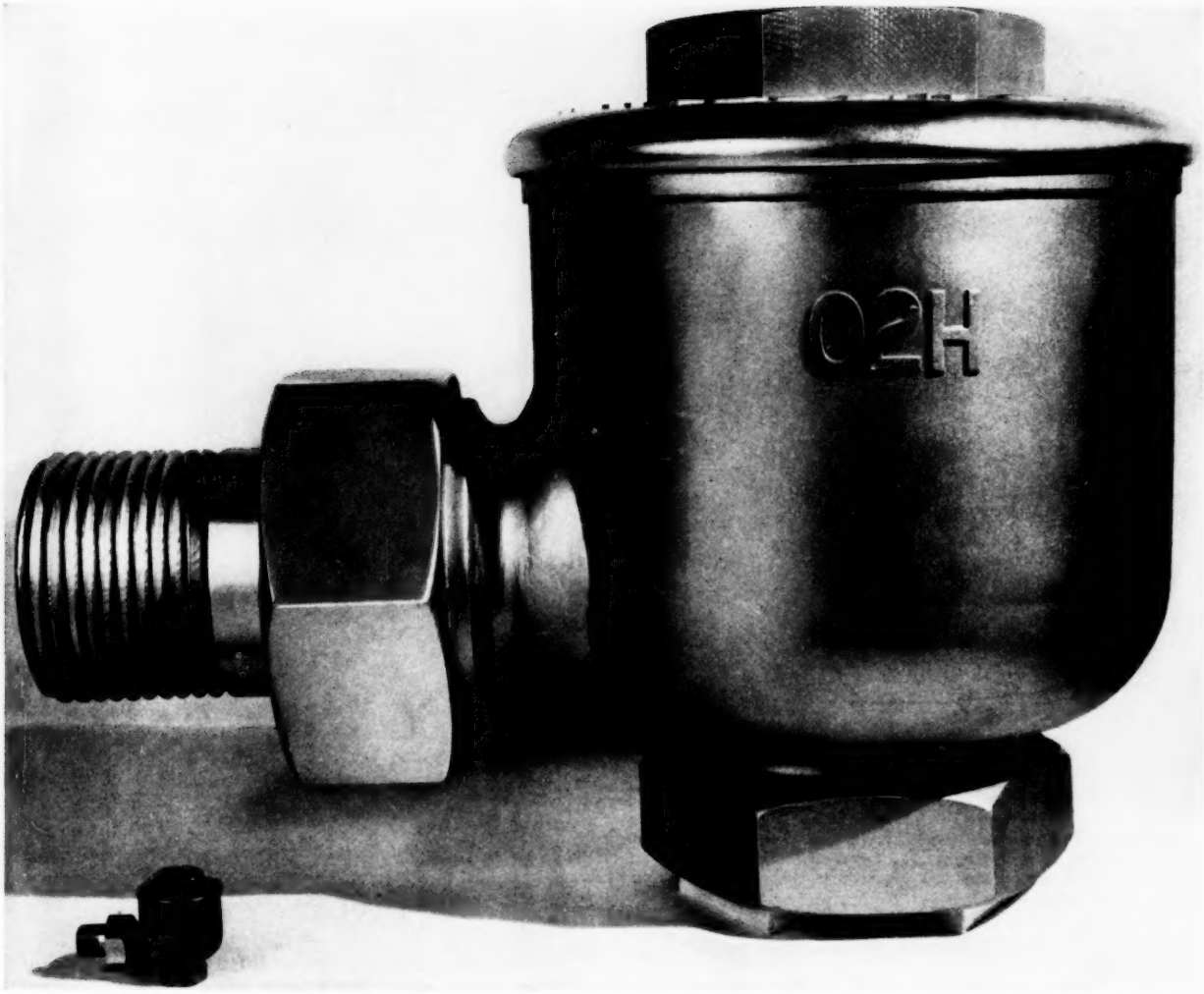


HOW BIFURCATOR WORKS

The Induced Draft Bifurcator is a motor driven axial-flow fan in a divided housing. Motor is in an isolated chamber around which flue gases are by-passed (bifurcated) so that the motor always remains cool, clean and accessible. Induced Draft Bifurcators are built in twenty-four sizes, for high pressure boilers delivering up to 60,000 pounds of steam per hour and for low pressure boilers rated up to 190,000 EDR.

DeBothezat Fans

Division of American Machine and Metals, Inc.
EAST MOLINE, ILLINOIS



. . . a small Trap — but BIG in performance

If you need complete data on Webster Steam Heating and Process Steam Specialties, get this binder of bulletins. Write for your copy today. Ask for Bulletin C-536.

It works all the time . . . automatically . . . discharging air and water of condensation . . . holding steam in radiators or steam-using equipment until it has given up its useful heat. It's a servant that never sleeps. It's your Webster Radiator Trap.

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Webster Traps, like all Webster steam heating specialties, give years of trouble-free service. Materials are selected for ability to withstand severe service. Parts are inspected after each manufacturing operation. No item leaves the factory until it has proved that it will function properly.

See your Webster Representative for complete data on Webster Radiator Traps, Radiator Valves, Float and Thermostatic Traps, Dirt Strainers . . . for low pressure vapor and vacuum steam heating service.

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Webster HEATING

HEATING AND VENTILATING

A MONTHLY MAGAZINE FOR ENGINEERS AND CONTRACTORS CONCERNED WITH THE DESIGN AND APPLICATION OF AIR CONDITIONING, REFRIGERATION, PIPING, PLUMBING, AIR SANITATION, HEATING AND VENTILATION IN BUILDINGS

September, 1953

VOLUME 50—NO. 9

The Cover: Airfoil-bladed centrifugal fans by Westinghouse serve Pittsburgh's Penn-Lincoln Parkway tunnels.

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Washington News

LORING F. OVERMAN

WITH Members of Congress vacationing or mending political fences, official Washington is being given its first opportunity to take a long look at what has been done; what remains to be done, and how to do it.

The first conclusion, after the smoke of Congressional oratory has cleared away, is that the American economy is surprisingly tough and resilient. The President's Council of Economic Advisers, in its August Report on Economic Indicators, found the picture anything but discouraging.

Gross national product, for example, was estimated at an annual rate of $372 billion during the second quarter of 1953—$4 billion more than the record figure reported in July by the same Advisers. The figure was also about $10 billion above estimated production during the first quarter.

Leveling Off

Several of the Economic Indicators showed signs that a leveling-off period may have been reached, although totals for the year to date remain considerably ahead of similar periods last year.

Construction, for example, showed that although July expenditures for new construction, seasonally adjusted, dropped below the early spring peak, the total for the first seven months of this year was 8% higher than for the like period of 1952. When adjusted for price changes, the total volume was also slightly above a year ago.

Expenditures for new plant and equipment are to be at the annual rate of $28.7 billion during the third quarter of this year, the Advisers predict. This would be at about the same rate as during the second quarter of this year, but about $3 billion more than was spent in the third quarter of last year. All major industry groups reported plans to spend more than a year ago.

New housing starts were also among the indicators showing weakness. Despite a decline in new nonfarm housing starts in June for the second consecutive month, the total for the first half of this year was 2% above the corresponding period in 1952. Private housing starts were 5% above last year, while public housing starts were 37% lower.

Total employment of 63.1 million was at a new high for the month of July, and close to the all-time peak reached in June. The seasonal drop in agriculture was offset by a small rise in nonagricultural industries. Unemployment, representing 2.4% of the civilian labor force, was about the same as in June, and one of the lowest on record for July.

Industrial production also signalled a possible leveling-off. The total is estimated to have declined about 4% in July. This, however, is said to be close to the usual seasonal decline during recent July periods, reflecting plant-wide vacations in many important industries.

Population 160 Million

On August 10 the Census Bureau turned up one of the reasons for the continued high consumer demand. Its population computer came up with 160 million as the total for the United States—several years ahead of the time when such a figure had seemed likely. If the same rate is continued, a population of 175 to 180 million by 1960 is a distinct possibility.

The Census Bureau's figure indicated that the population had increased by 20 million in a little over eight years. For the sales engineer who likes to think in terms of hospitals, homes, schools, colleges and the like needed for such a population, the markets based on such a population are fantastic. Sobering, too, is the possibility that by 1975 some 93 million people will be of employable ages. How to busy some 30 million more persons than are employed today is indeed a challenge to industry and ingenuity.

But the reward for meeting such a challenge will be a vast expansion of markets for all the things the heating, ventilating, and air conditioning industry can supply. It is another of those things which official Washington is eyeing with no little concern.

The Road Back

One thing appears certain. Official Washington is dedicated to the premise that government must look to industry to supply the jobs that provide the incomes to buy the products that such a huge new work force will produce. Consequently, the next step in Washington's program to trim federal expenditures will be to slash government functions. During the first six months in Washington, the new Administration was concerned with streamlining the existing work of various agencies. The result has not been too encouraging, even though some $12 billion has been trimmed from next year's budget.

So the next step will not be limited to improving the work done. Instead, the goal will be to take government out of competition with business wherever it is possible to do so. In charge of this interesting assignment is a new Hoover Commission. Unlike its predecessor, the new Hoover group will not be concerned primarily with efforts to eliminate waste within existing agencies. Instead, it will be expected to stop the spread of bureaus, and recommend the return of business to private enterprise.

Such an objective has political ramifications which may assert themselves at the next elections, when all of the House and one third of the Senate are to be named. There are many who question whether, after 20 years on a port tack, the ship of state can weather the waves of criticism that a starboard course may encounter. Again, the answer will lie with the voter, and with the ability of business to convince the average man and woman that the new course is to be preferred.

Field Service Cooperative

Meanwhile, the effort to coordinate government and business is getting away to a good start through the newly organized Field Service Cooperative Office program of the Department of Commerce. The program already involves a nationwide network of 740 private busi-

Insulation can be a White Elephant

It can clutter up a building site.
And if it rains before
the building's up . . . !

STORAGE SPACE at building sites, even outdoors, is so scanty, that bulky ordinary insulations are often left exposed to the weather, even to rain, before and during installation. Soon they are sopping wet.

Pilferage and where to put other materials become pressing problems. Ordinary insulation, packaged, occupies 131 times as much cubic space as equivalent multiple aluminum. Two under-the-arm cartons of multiple accordion aluminum insulate the average dwelling (providing 2000 sq. ft.); can be toted to the job on a bus; offer no storage problem. They are easily stowed in a tool bin or in a car; 10,000 sq. ft. on the back seat; 5000 sq. ft. in the luggage compartment.

Moisture destroys insulation values. Water in the interstices of a material is an excellent heat conductor. Standard thermal factors for ordinary insulations refer only to a BONE-DRY condition. Excessive moisture causes peeling paint, crumbling plaster, rotting wood.

Excessive condensation is sometimes produced inside building wall and roof spaces if metallic vapor barriers are not used to prevent excessive passage of water vapor from the warm side of the ceiling or wall space to the colder surface, where it condenses.

With sufficient pressure differential, water vapor, a gas, will flow through any part of the surface of asphalt "vapor barriers." The surfaces of multiple accordion aluminum are impervious to water vapor. The insulation is practically non-condensation-forming, and will not absorb moisture.

There is now a new standard Infra Insulation (the commercial form of multiple accordion aluminum) improved to form a "blanket" of *uniform* depth between studs and joists which completely covers the spaces between. Samples of the new Infra Insulation and a description sent on request.

COST OF THE NEW* INFRA INSULATION INSTALLED
in new construction between wood joists, material with labor,
Type 6-Si under 9½¢ sq. ft.
Type 4-Si under 7½¢ sq. ft.
Type 4-S Jr. under 7½¢ sq. ft.
*Patent applied for.

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Please send me sample of New Infra Insulation ☐
Copy of Schwartz's "Simplified Physics" ☐

Name .....

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ness organizations, linked with the Commerce Department's field offices. The network enlists the voluntary services of chambers of commerce and similar civic groups. More than 150 offices joined the network between July 1 and mid-August, and scores more are expected to sign up soon.

Under the cooperative plan, each organization in the nationwide Cooperative Office program will provide the services of a privately employed individual or staff to make available locally Government publications, statistical data, trade reports, business surveys, lists of proposed federal procurement of goods and services, and other Commerce Department information of value to the public and to business.

Down with Taxes

Under such programs as the Commerce Department Field Service Cooperative, and the Hoover Commission's efforts to trim federal functions, a natural dividend should be a tax reduction.

Chairman Daniel A. Reed, of the House Ways and Means Committee, has announced that a comprehensive tax revision bill will be the "first order of business" for his committee when it reassembles. The committee completed hearings on August 14, after listening to more than 600 witnesses who discussed 40 major topics involving as many phases of tax laws.

"A comprehensive tax revision bill will be the first order of business of this committee next session," promised Chairman Reed. "Between now and next January, technical staff experts will be studying the evidence presented in order that a bill can be prepared and considered promptly. This work has already been going on for many months.

"We want to reduce the many unfair restrictions which the present tax laws impose on our taxpayers. We want to remove nuisance requirements which serve little purpose except to harass and annoy. It is a tremendous undertaking—the most important legislative task which the Congress has attempted for many years. Too often, in the past, such a program has been pushed aside because of some supposed emergency. This time, we are going to do the job."

With the Ways and Means Committee pledged to such a new and improved tax program, a word from the voter to Members of Congress would indeed prove timely. The months ahead are the ones in which Congressmen and Senators will be asking for guidance from their constituents.

Official Belt-Tightening

In an effort to avoid a Fall special session of Congress, President Eisenhower has urged the heads of federal departments and agencies to search out possible economies "with renewed vigor." A special session would be necessary, it is explained, unless expenditures can be held below the present national debt limit of $275 billion.

Just before Congress adjourned, the President asked for an increase to $290 billion, but the Senate refused to go along. Only recently, the Treasury Department has indicated that it may be possible to get by at the $275 level. Thus may be proved again, Congressman Daniel Reed's premise that the best way to force economies is to tighten the purse strings.

Defense Procurement

The Korean truce appears to be resulting in no long range changes in the defense program. Some shifts have been made in ammunition procurement contracts, and some of the plane and tank programs have been consolidated. In general, however, defense planning continues unchecked, although with certain refinements.

For example, in mid-August it was expected that Defense Secretary Charles E. Wilson would soon issue a new definition of the authorities and responsibilities of Charles S. Thomas, Assistant Secretary for supply and logistics. The directive was expected to be the first of several to be issued by Mr. Wilson to each of the six new Assistant Secretaries of Defense.

Under the new Supply and Logistics charter, Mr. Thomas was to be given wide authority over procurement, production, distribution and storage activities of the military services. He is to handle program planning, including mobilization readiness, under the strategic plans of the Joint Chiefs of Staff; mobilization base activities, including the management of government-owned machine tools, and the development of a single supply catalog for the services. Mr. Thomas is also understood to be assigned the matter of transportation, including avoidance of cross-hauling; effective warehousing, and the development of uniform specifications wherever possible for the three services.

Only exception to the rule that the Korean truce will not result in immediate economies may lie in the field of soft goods. The Pentagon has been alerted to do all it can to help avoid calling Congress for a debt-expanding special session. Indications are that the Pentagon can arrange some cutbacks in soft goods, and that it can effect some savings by drawing on inventories of spare parts. Maximum estimated savings, in the event the truce continues, amount to one billion dollars, less the $200 million which has been ordered diverted from defense funds to rehabilitation relief in Korea.

NPA Eases Requirements

The National Production Authority no longer requires industry to file Form NPAF-1. Selected companies in metal-working industries have been required to submit the form on a quarterly basis as basis for estimating requirements for defense purposes. Decision to discontinue the forms, beginning with the third quarter, was announced by H. B. McCoy, acting NPA director. He emphasized the important rule the form has played during the life of CMP, and indicated that if there is a further need for use data, the information will be collected by means of an individual industry spot check rather than through the collection of regular reports from all consumers of metal.

Government Manual Ready

The 1953-54 edition of United States Government Organization Manual—a 734-page revised manual which serves as the official organization handbook of the Federal Government—can be purchased at $1.00 from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

The revised Manual includes changes made in accordance with the President's Reorganization Plans of 1953.

Here's why CORROSION COSTS YOU MORE than WROUGHT IRON

IT TAKES ONLY ONE TO INSTALL PIPE...

BUT FIVE TO REPAIR IT!

One of the most convincing demonstrations of the economy of using *durable* material is a pipe repair job where low-first-cost material has failed and is being replaced.

The original installation had been quickly made by plumbers. But the replacement calls for hours of work by as many as five crafts: plumber, mason, plasterer, carpenter, painter. Often, maintenance is billed at overtime rates. And this is only part of the cost story. Production slow-down, disrupted routine may amount to far more than the maintenance charges.

Fortunately there's an answer to pipe durability in corrosive services Byers Wrought Iron pipe. In literally thousands of applications where corrosion is a threat, the use of this material has proved the soundest kind of economy move.

The next time you specify or approve pipe, you'll find it profitable to investigate the durability records of wrought iron.

Our bulletin, "The ABC's of Wrought Iron," gives the what, why and where of this material. Write for a copy.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. Export Division: New York, New York.

Remember— the pipe that lasts the longest costs the least!

FOR PRODUCTION CONTINUITY LOWER MAINTENANCE— Insist on Byers WROUGHT IRON PIPE

BYERS

CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

BRIEFLY STATED

• Application of electric motors to the air moving industry, will be the subject of a three-day conference under auspices of the Fort Wayne section of AIEE to be held October 6, 7, and 8 at the Hotel Van Orman, Fort Wayne, Indiana. A program of 14 papers on special problems in heating, air conditioning, and ventilation equipment will be followed by a symposium on induction motors. Program is aimed at furthering cooperation between motor and equipment manufacturers.

• Designed to make "young" Colorado coal grow several million years older in a matter of minutes, a new pilot plant for the test production of char has been completed at the Pueblo steel mill of The Colorado Fuel and Iron Corp. The new Petit char plant is the second of its kind in the world. Colorado coal is believed to be about 80 million years younger than eastern coal. It is therefore more highly volatile. The new char plant is actually a low-temperature furnace which removes part of the excess volatile matter of this western coal, producing a low-volatile coal or char for blending with other coals. Mixing the resultant char with Colorado coking coal improves the quality of coke, which is later used in steel making.

• Clark M. Humphreys has been appointed acting director of research for ASHVE. Since 1945, Mr. Humphreys has served as senior engineer and recently has supervised the work on the human calorimeter and the construction of the environment and odor rooms.

• A two million dollar expansion program at two plants manufacturing Freon fluorinated hydrocarbon compounds for the refrigeration and aerosol industries has been announced by the Du Pont Company.

• At the 1953 Annual Meeting of the American Society for Testing Materials, held June 28-July 3 at Atlantic City, seventy-two of the Society's technical committees reported, with the result that 63 new specifications and tests were approved. All of these new tentatives will be published later in the year in the 1953 Supplement to the Book of ASTM Standards. They will also be available separately at a nominal charge for each copy.

• A new name, Weathertron, and a new science, Weathertronics, will be used in describing General Electric's heat pump and the Company's activities in the heat pump field.

• Appointment of K. T. Davis as Director of Engineering and product development for Bryant Heater Division, Affiliated Gas Equipment, Inc., has been announced. Mr. Davis, who joined Bryant in 1942, served for nine years as Bryant's chief engineer, and since 1952 has been manager of Bryant's Sales Engineering Department.

• William G. Wright has assumed the duties of executive assistant to president H. S. Marshall of the C. A. Dunham Co., Chicago heating equipment manufacturer. Mr. Wright was recently manager of marketing at Panellit, Inc., Chicago manufacturer of instrument and control panelboards.

• John Dunn, formerly in charge of burner sales for Peabody Engineering Corp., New York, N. Y., has been appointed general sales manager.

• The Department of Architecture at Pratt Institute will sponsor a series of six Tuesday evening meetings on radiant heating during October and November. Authorities in the fields of design, research, equipment, and materials have consented to participate in an over-all analysis of this type of heating. Admission will be free of charge.

• C. W. Farrar, formerly vice president and general sales manager of Richmond Radiator Co., New York City, has rejoined W. A. Case & Son Mfg. Co., Buffalo, N. Y., as administrative officer, sales promotion and advertising.

• Orr & Sembower, Inc., Reading, Pa., manufacturer of packaged automatic boilers, has announced the opening of a New York office at 51 East Forty-Second Street. Jared Darlington III is district manager supervising the field sales activities in the metropolitan area including Westchester County, Long Island and northern New Jersey.

• New officers of the Gas Appliance Manufacturers Association will be headed by Sheldon Coleman of Wichita, Kans., elected at the group's 13th annual meeting. Mr. Coleman, president of The Coleman Co., Inc., succeeds James F. Donnelly, vice president in charge of sales of Servel, Inc., of Evansville, Ind.

• Harry L. Williamson, Jr., has been appointed manager of marketing of the General Electric Company's heat pump department. Mr. Williamson was formerly manager of advertising and sales promotion of the company's Locke Department in Baltimore.

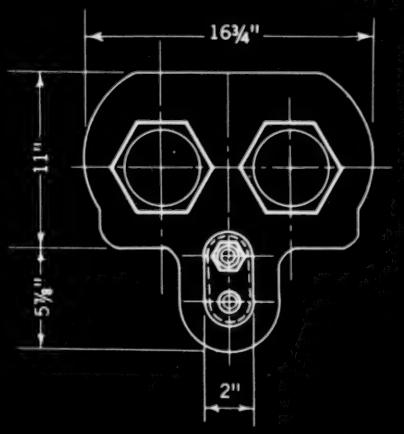
• Unique rooftop electronic sensing elements measure the heat of the sun beating down on the Pentagon. They are part of a system for controlling the building's air conditioning system, believed to be the world's largest. To control the huge air conditioning system, consulting engineer Charles Leopold of Philadelphia in collaboration with Minneapolis-Honeywell engineers conceived a novel automatic system which literally anticipates weather changes to adjust indoor temperatures.

• The Torrington Manufacturing Co., manufacturer of propeller fan blades, blower wheels, spring coiling machines and auxiliary mill machinery, has announced the start of construction of a half-million dollar plant addition, totalling 46,125 sq ft. The new, single-story facility is expected to be completed before the end of this year adjacent to Torrington's Air Impeller Division buildings.

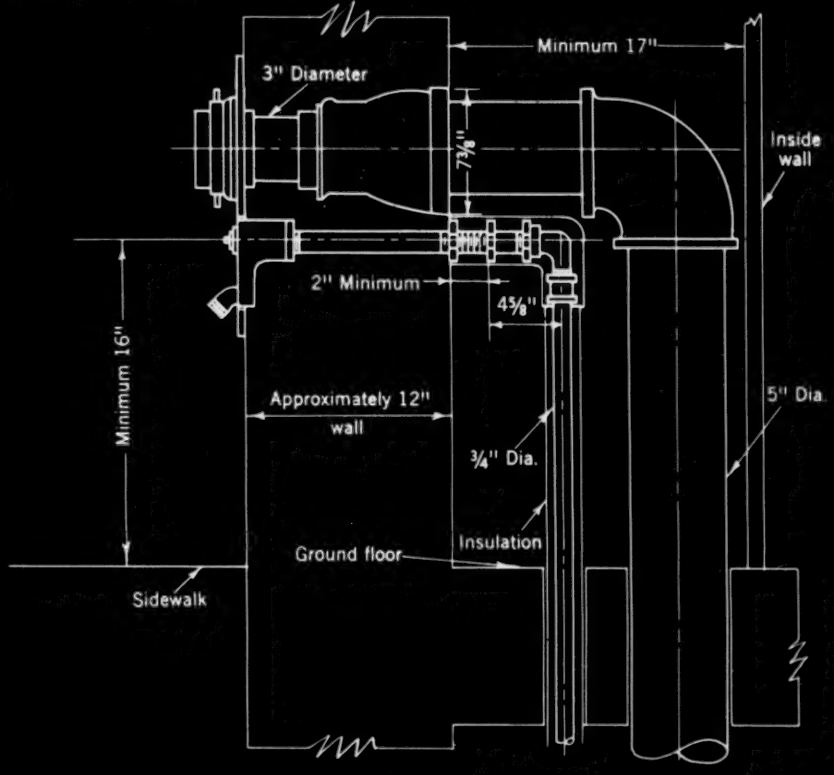
• Lucien W. Moore, Crane Co. director of purchases, was elected vice president and George L. Larson, general superintendent of the company's Chicago Works, was appointed executive assistant at a meeting of the Crane Co. board of directors.

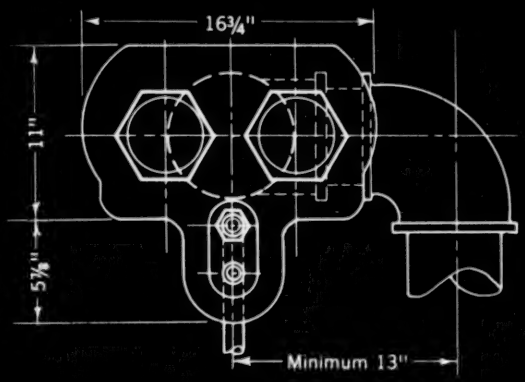
• In a move to expand the scope and activities of the Refrigeration and Air Conditioning Contractors Association, the Association obtained the services of Ray Kramer as executive vice president at its recent directors' meeting in Minneapolis.

SIAMESE AND SILLCOCK CONNECTIONS

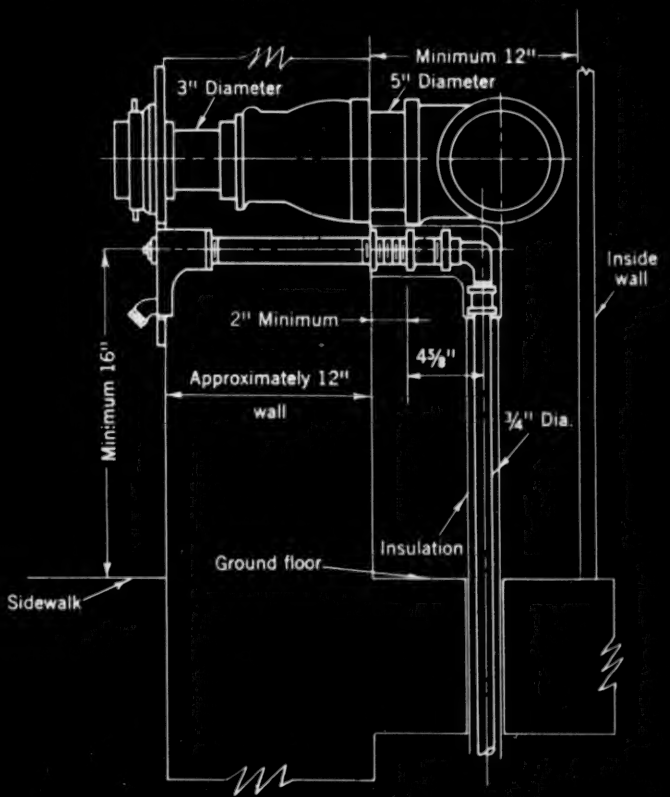


SIAMESE WITH STRAIGHT HORIZONTAL RUN



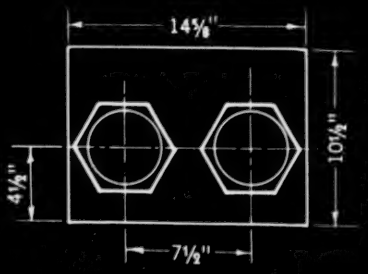


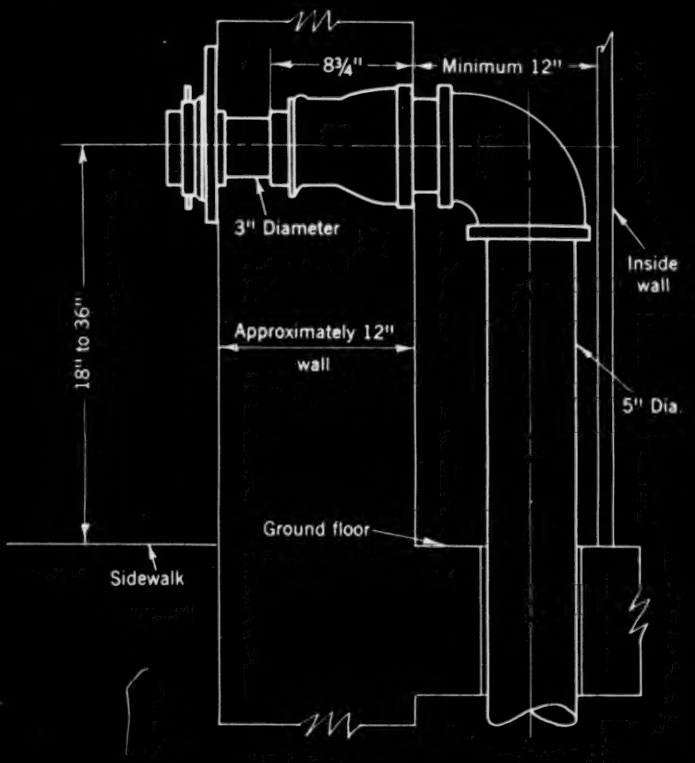
SIAMESE WITH TURN IN HORIZONTAL RUN



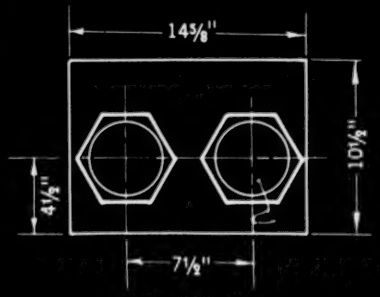
HEATING AND VENTILATING'S DETAIL SHEET

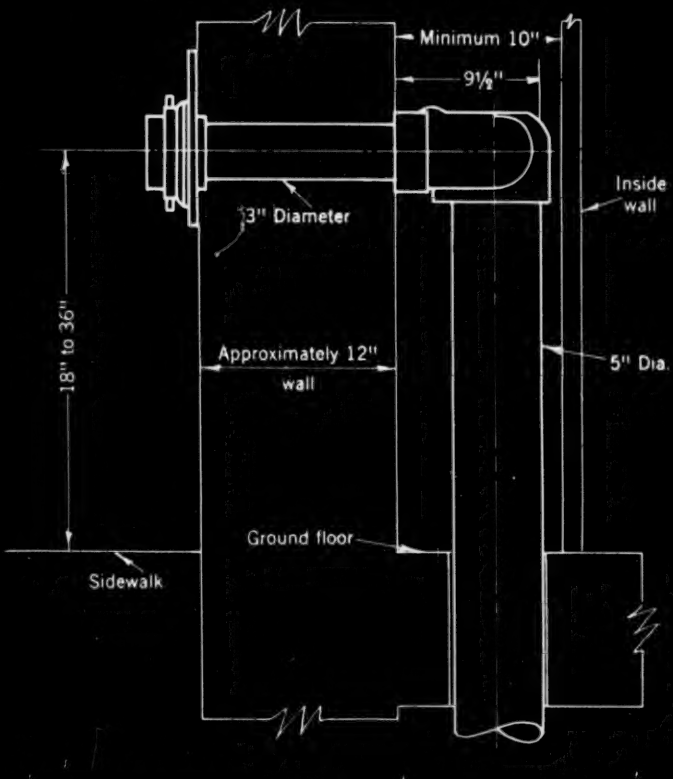
SIAMESE CONNECTIONS





SIAMESE WITH STRAIGHT HORIZONTAL RUN





SIAMESE WITH TURN IN HORIZONTAL RUN

PIPING DETAILS THROUGH THE COOPERATION OF SYSKA & HENNESSY, INC., NEW YORK, N.Y.

HEATING AND VENTILATING'S DETAIL SHEET

JENKINS PRACTICAL PIPING LAYOUTS

68

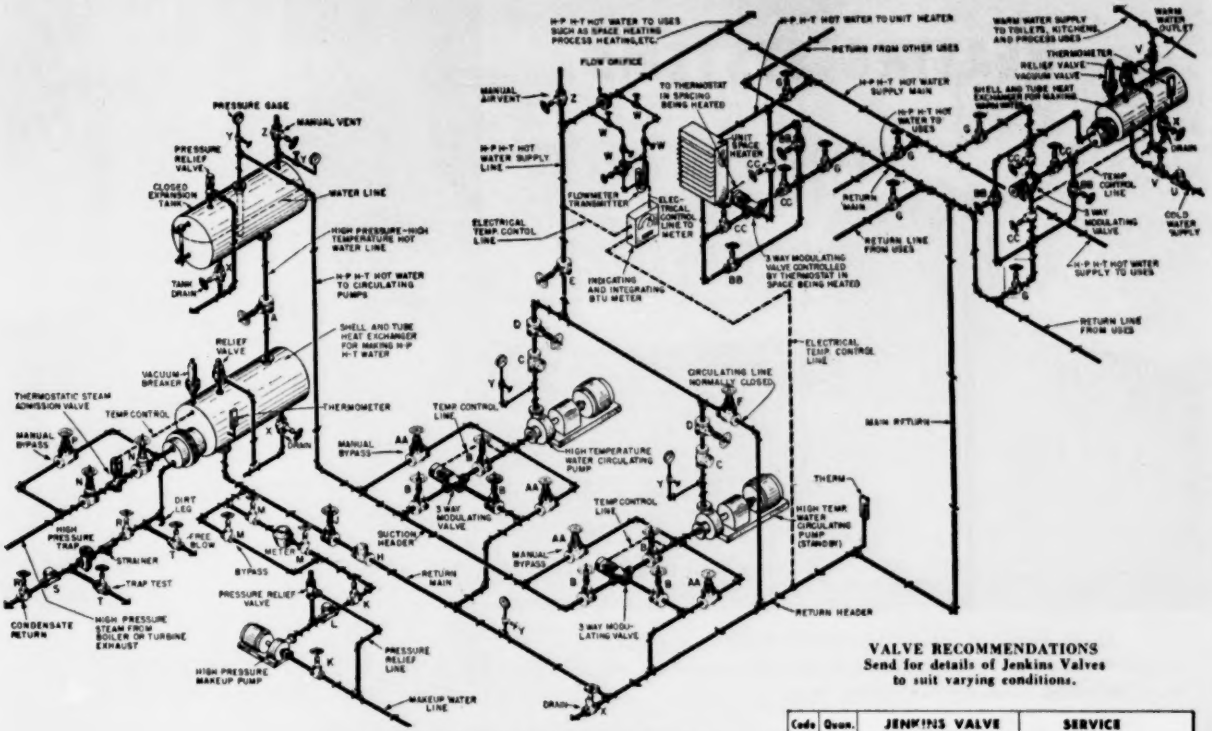


Diagram by Huxley Madeheim, Consulting Engineer
COPYRIGHT, 1953 — JENKINS BROS.

VALVE RECOMMENDATIONS
Send for details of Jenkins Valves to suit varying conditions.

Code	Quan.	JENKINS VALVE	SERVICE
A	1	Fig. 204 IBBM Gate	HP-HT Hot Water Shutoff
B	6	Fig. 204 IBBM Gate	3 Way Valve Shutoff
C	2	Fig. 339-R IBBM Swing Check	Prevent Backflow
D	2	Fig. 204 IBBM Gate	Pump Discharge Shutoff
E	1	Fig. 204 IBBM Gate	Supply Line Shutoff
F	1	Fig. 923 IBBM Globe	Circulating Line Shutoff
G	6	Fig. 280 Bronze Gate	Branch Shutoffs
H	1	Fig. 339-R IBBM Swing Check	Prevent Backflow
J	1	Fig. 204 IBBM Gate	Return Main Shutoff
K	2	Fig. 280-U Bronze Gate	Makeup Pump Shutoff
L	1	Fig. 962 Bronze Swing Check	Prevent Backflow
M	3	Fig. 280 Bronze Gate	Makeup Meter Shutoff
N	2	Fig. 1010 Cast Steel Gate	Thermostatic Valve Shutoff
P	1	Fig. 1042 Cast Steel Globe	ThermostaticValveBypass
R	2	Fig. 280-UN Bronze Gate	Condensate Line Shutoff
S	1	Fig. 962 Bronze Swing Check	Prevent Condensate Backflow
T	2	Fig. 976-A Bronze Globe	Trap Test, Free Blow
U	1	Fig. 352 Bronze Swing Check	Prevent Backflow
V	2	Fig. 47-U Bronze Gate	Cold Water Shutoff
W	4	Fig. 703 Bronze Globe	Flow Meter Pressure Taps
X	4	Fig. 976-A Bronze Globe	Drain Lines
Y	5	Fig. 703 Bronze Globe	Pressure Gage Control
Z	2	Fig. 976-A Bronze Globe	Air Vents
AA	4	Fig. 923 IBBM Globe	3 Way Valve Bypass
BB	4	Fig. 976-A Bronze Globe	3 Way Valve Bypass
CC	6	Fig. 280 Bronze Gate	3 Way Valve Shutoff

How to plan a HIGH PRESSURE-HIGH TEMPERATURE HOT WATER PIPING SYSTEM

For efficient space and water heating — and for numerous processing needs as well — a high pressure-high temperature system offers several distinct advantages over a steam system.

Often operated at pressures up to 215 psi, with a corresponding temperature of 388°F, a HP-HT system of this type eliminates the need for pitch, drainage, or traps and provides a greater amount of heat transmission for a given pipe size. Moreover, it requires no feed-water treatment and, when used for processing services, eliminates large pressure drops due to sudden load conditions.

The hot water is generated in a shell and tube heat exchanger by means of high pressure steam from either turbine extraction or exhaust. Unit heaters on the HP-HT lines provide for space heating requirements and a shell and tube heat exchanger supplies warm water for lavatories, kitchens, and processing which requires moderate temperatures. When used with accumulators, this system eliminates the need for taking additional steam directly from the steam generating source and, thus, provides a better plant heat balance.

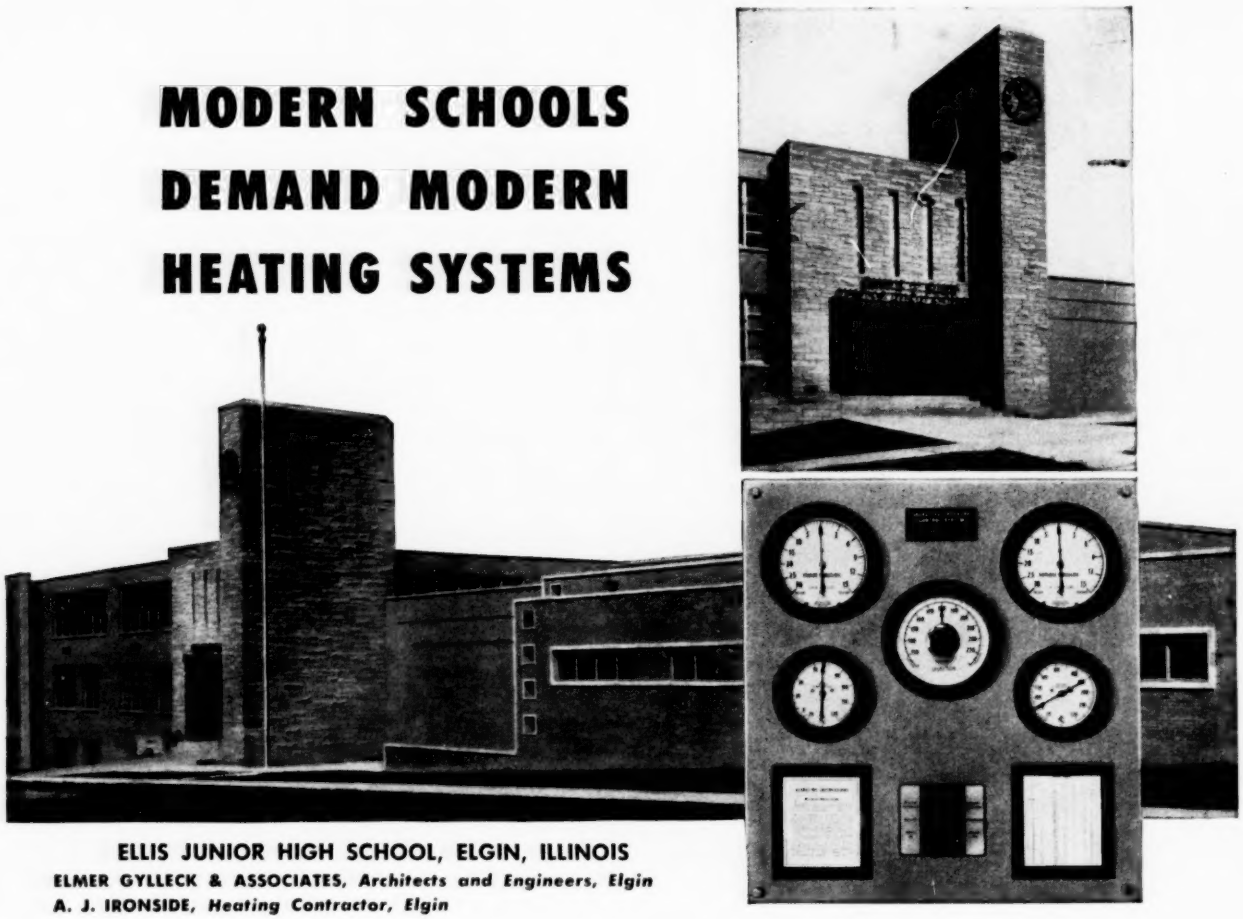
Consultation with accredited piping engineers and contractors is recommended when planning any major piping installation.

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering experience, select all the valves you need from the complete Jenkins line. It's your best assurance of *lowest cost in the long run.* Jenkins Bros., 100 Park Ave., New York 17.

Complete description and enlarged diagram of this layout free on request. Includes additional detailed information. Simply ask for Piping Layout No. 68.

JENKINS VALVES
LOOK FOR THE DIAMOND MARK
TRADE JENKINS MARK
Jenkins Bros

MODERN SCHOOLS DEMAND MODERN HEATING SYSTEMS



ELLIS JUNIOR HIGH SCHOOL, ELGIN, ILLINOIS
ELMER GYLLECK & ASSOCIATES, *Architects and Engineers, Elgin*
A. J. IRONSIDE, *Heating Contractor, Elgin*

This is the fourth Elgin school to enjoy the comfort, convenience, and economy of an

ILLINOIS High Vacuum Control System

(Type "C" Generation Control)

Simplicity of operation is an outstanding feature. *The entire heating system is controlled at ONE POINT . . . the SELECTOR in the center of the control panel.*

Other Illinois heating systems include Type "A" Pneumatic and Type "R" Electric Zone Control as well as the standard vacuum and vapor systems.

WRITE FOR BULLETINS

ILLINOIS ENGINEERING COMPANY
INCORPORATED 1900
RACINE AVENUE AT 21ST STREET • CHICAGO 8

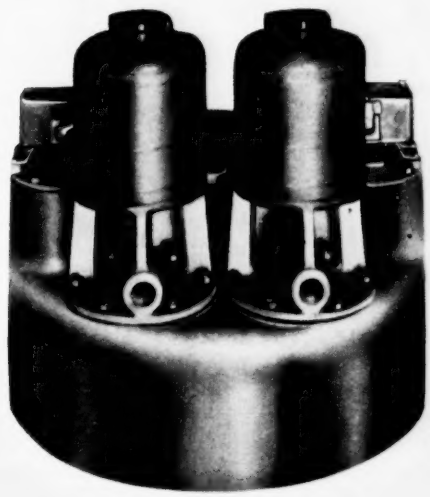
SKIDMORE'S latest contribution

MAINTAINED SKIDMORE PUMPS EFFICIENCY

THE NEW "CV" DUPLEX UNIT --- TAKES THE SPOTLIGHT!

A worthy complement to the popular "CV" single unit and a fine addition to the Skidmore family. Equipped with either individual float switches or automatic alternating float switch, the new Skidmore Duplex Unit now provides a simple positive means of alternating the operation of two pumps installed on a duplex unit with a common receiver, and insures even wear of the pumping unit. The Duplex Unit incorporates all the desirable features of the single unit. Compact and dependable, the unit requires a minimum of space and offers wide range of selectivity . . . this adds up to low installation cost and long trouble-free service. Pump is bronze fitted throughout with enclosed centrifugal impeller, stainless steel shaft, self lubricating bronze bearing and low return connection.

Left—Type "CV" Single Unit
Right—Type "CV" Duplex Unit



WRITE FOR NEW BULLETIN NO. 21-A
Contains engineering data on the Single and the Duplex Units.

Skidmore Heating Pumps for Improved Efficiency — SINCE 1921

SKIDMORE CORPORATION ● ST. JOSEPH, MICHIGAN

PHOTO OF UNICON INSTALLATION
AT SHOYER'S RESTAURANT, PHILA., PA.
BY ATLANTIC REFRIGERATION AND EQUIPMENT CO.,
PHILA., PA.

No Water needed for Condensing

WITH THE

UNICON

TRADE MARK

by KRAMER

Any Size compressor REGARDLESS OF TONNAGE can be Air-Cooled with UNICON

If water is a problem,
there is only one CORRECT SOLUTION—
UNICON by Kramer,
the air-cooled condenser that DOES NOT USE WATER!

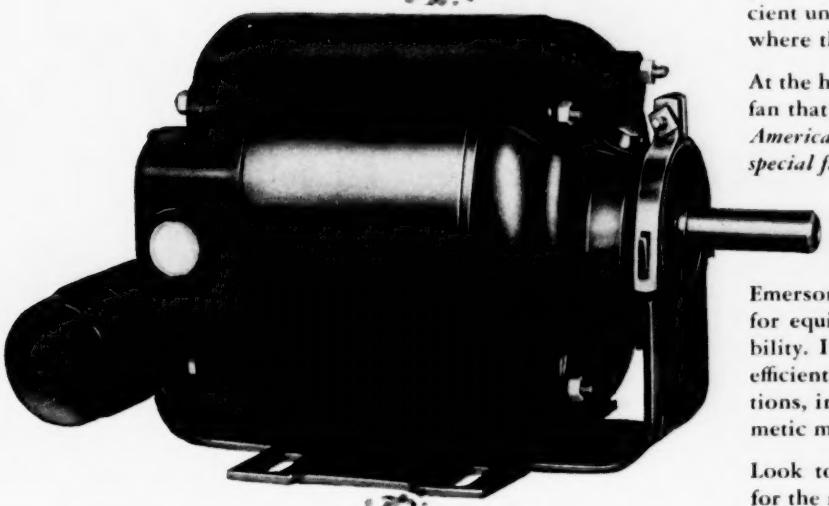
Two types—the direct drive and the belt drive—
are available for ¾ to 100 H.P.

Stands, hoods, and wind deflectors are available for simplified mounting. You need nothing else!

WRITE FOR BULLETIN U-210

KRAMER TRENTON CO. • Trenton 5, N.J.

It tells heat where to go!



It would be a cold day in many an industrial plant without modern unit heaters. These efficient units pour out warmth and comfort right where they are needed.

At the heart of each unit is a quiet, dependable fan that sends the heat on its way. *On many of America's best known unit heaters Emerson-Electric special fan-duty motors power the fans.*

Emerson-Electric specializes in building motors for equipment with a reputation for dependability. It has done so for 63 years, and offers efficient motors for a wide variety of applications, in ratings from 1/20 to 5 h.p., and hermetic motors ⅛ to 20 h.p.

Look to Emerson-Electric if you are looking for the right motor to power your product efficiently, dependably. Your inquiry is invited.

THE EMERSON ELECTRIC MFG. CO.
St. Louis 21, Mo.

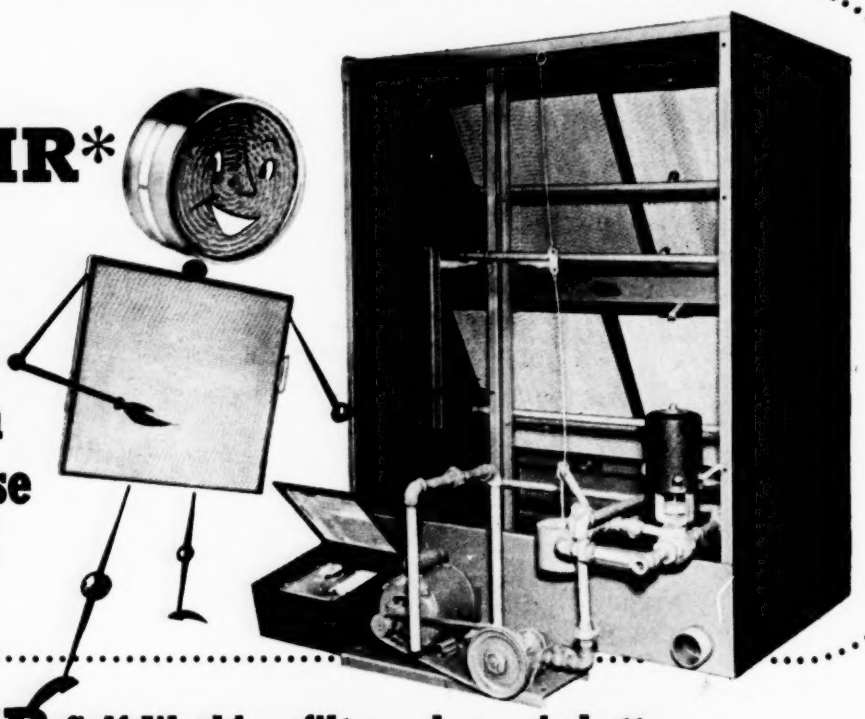
Write for these Emerson-Electric Motor Data Bulletins

Manufacturers requiring motors 1/20 to 5 h.p. can profitably use these reference guides. Specifications, construction and performance data are included for these motors:

- ☐ 438-A Capacitor-Start
- ☐ 438-B Split-Phase
- ☐ 438-C Integral
- ☐ 438-D Fan-Duty
- ☐ 438-E Oil-Burner
- ☐ 438-F Jet Pump
- ☐ 438-G Blower

EMERSON ELECTRIC
MOTORS • FANS APPLIANCES

only FAR-AIR* gives you completely automatic air filtration with all these advantages!



FAR-AIR Self-Washing filters clean air better . . . provide these automatic features, too!

FAR-AIR Self-Washing filters give you more efficient, more dependable service. That's because FAR-AIR's exclusive herring-bone-crimp media design permits progressive loading and free air flow.

Find out today about completely *automatic* air filtration.

Washing, drying and oiling is controlled electrically on a pre-determined time schedule . . . *automatically!* Air cleaning efficiency remains constant. There is no liquid particle entrainment.

Water and dirt are flushed directly to sewer . . . *automatically!* There is no messy oil sump to collect sludge and create a fire hazard. Maintenance man-hours are reduced. Built-in controls guard against fire . . . *automatically!* These are Far-Air features:

No entrainment • No sludge—no oil sump
Automatic fire control • Minimum maintenance
Easy installation

FAR-AIR FILTERS

"Better by Farr"

*Trade Mark Reg.

FARR COMPANY

Manufacturing Engineers

CHICAGO • LOS ANGELES • NEW YORK

Mf'd under license by Control Equipment Co., Ltd.
Montreal, Canada

MAIL COUPON NOW FOR COMPLETE INFORMATION!

Farr Company, P. O. Box 10187, Airport Station,
Los Angeles 45, California

Please send me information on FAR-AIR Self-Washing filters.

I would ☐ would not ☐ like a Farr Field Engineer to discuss my air filtration problem with me.

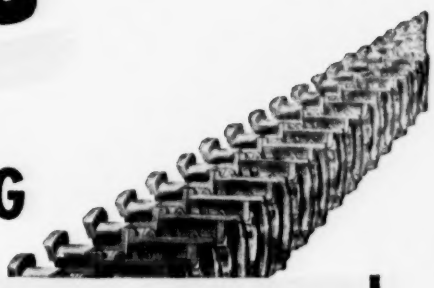
Name _____ Title _____

Company _____

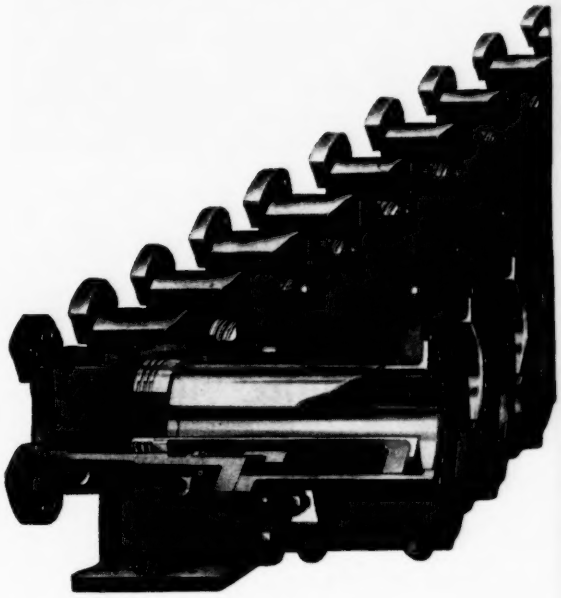
Address _____

6500 JOINTS

CAN'T BE WRONG



● You're sure to find the right one at **ADSCO**



No matter what expansion joint you need, look first among ADSCO's 6500 standard slip models. Manufacturing the world's most complete line of expansion joints, ADSCO is able to make a thorough analysis of your pipe expansion problems and to offer an impartial recommendation on the type of joint to use. Even if your problem is a unique one, remember that ADSCO has specialized since 1877 and can readily engineer a special joint to fit your needs.

King of ADSCO slip joints is the Piston-Ring, shown here. This exceptionally well-engineered and well-built joint carries the mark of ADSCO quality. Piston-ring feature permits it to be unpacked and repacked while maintaining full line pressure; thus service is not interrupted. Limit stops prevent over-travel of slip. Polished surface of slip cannot be scored because it is in contact with packing only. True alignment is assured by both internal and external guiding; split external guide permits smaller manholes. Full range of sizes, with 4", 8" and 12" traverse per slip, for pressures to 400 psi and greater and for temperatures to 800F and higher. Call an ADSCO representative or write for Bulletin 35-15H.

Use ADSCO Alignment Guides With ADSCO Expansion Joints

Don't let pipes get out of line. Use ADSCO Alignment Guides. Cylinder is 12" long in all sizes, permitting pipe movement of 10". Damage to insulation prevented by ample clearance between guiding cylinder and pipe.

ADSCO ENGINEERED PRODUCTS

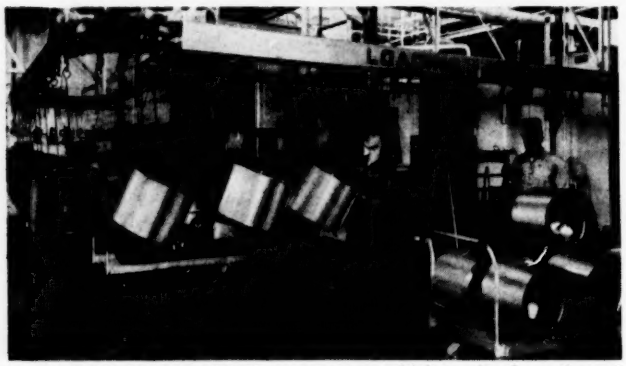
EXPANSION JOINTS
HEAT EXCHANGERS
STEAM TRAPS
STRAINERS
SEPARATORS
METERS

AMERICAN DISTRICT STEAM COMPANY, INC.

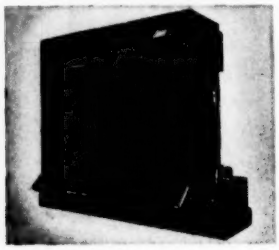
NORTH TONAWANDA, NEW YORK

Since 1877

SPRAYING CORROSION-RESISTANT ENAMEL on metal panels for Worthington evaporative condensers and air conditioners. This chlorinated rubber base enamel, selected by Worthington after rigorous tests, resists chipping and long exposure to salt fog, acids, alkalis, ultra-violet light, and high and low temperatures.



FAN HOUSINGS ARE LOADED on conveyor which carries them through Worthington special 5-stage washing process. This washing, which includes sprays of Bonderite and mild chromic acid solution, prepares the equipment for the corrosion-resistant enamel.



YEARS OF TROUBLE-FREE SERVICE are assured with this Worthington evaporative condenser. The corrosion-resistant finish, rugged construction, large diameter hollow fan shaft and self-aligning ball bearings are some of the features that make this unit the finest available. You can get a Worthington evaporative condenser in any one of 18 sizes, in capacities of 10 to 150 tons.

Rustproof finish adds years to life of air conditioning equipment

For years, corrosion has presented a real problem in air conditioning and refrigeration equipment. Brine spray, water, fumes—all caused metal equipment to corrode. To combat this, Worthington engineers developed the bonderized two-coat baked chlorinated rubber enamel finish now used on all Worthington air conditioning and refrigeration units.

This finish, the result of years of testing and research, completely protects the metal against corrosion and preserves the original appearance of the equipment. Rigorous tests have shown that this finish will last at least three to four times longer than the best hot-dipped galvanizing coating.

Advances in construction and design like this are standard practice with Worthington, a leader in air conditioning and refrigeration for over half a century. From giant industrial refrigeration systems down to the air-conditioner for a baby's nursery, Worthington can handle any job, and provide exactly the right equipment. So when you think of air conditioning or refrigeration—think of Worthington.

For more information, get in touch with your nearest Worthington distributor. Or write to Worthington Corporation, Air Conditioning and Refrigeration Division, Section A.3.40, Holyoke, Mass.

A.3.40

WORTHINGTON

CLIMATE ENGINEERS TO INDUSTRY, BUSINESS AND THE HOME

BUILT TO MEET MODERN INDUSTRIAL REQUIREMENTS

For Continuous Heat Service up to 150 Pounds Steam Pressure

Horizontal Type

Ceiling suspension type with heavy duty welded steel fin-and-tube heating element. The rugged arc-welded construction outperforms and outlasts heating elements made of thinner non-ferrous metals. Avoids their expansion-contraction faults, yet has the same BTU efficiency. Ten basic sizes with capacities from 30 Mbh to 490 Mbh. Totally enclosed motors. (Extra heavy non-ferrous coils also available.)

Vertical Projection Type Also Available

For efficient heating from high-ceiling areas—for door heaters over small openings—or where the horizontal type is not applicable. Ten basic sizes; capacities from 27 to 332 Mbh.

Write for Bulletins

No. 513 Horizontal Type

No. 516 Vertical Type

IUHA HEAT WITH UNIT HEATERS

SEE OUR CATALOG IN SWEET'S

CERTIFIED RATINGS

All New York Blower Company products are laboratory tested, accurately rated and fully guaranteed in strict accordance with Standard Test Codes.

THE NEW YORK BLOWER COMPANY

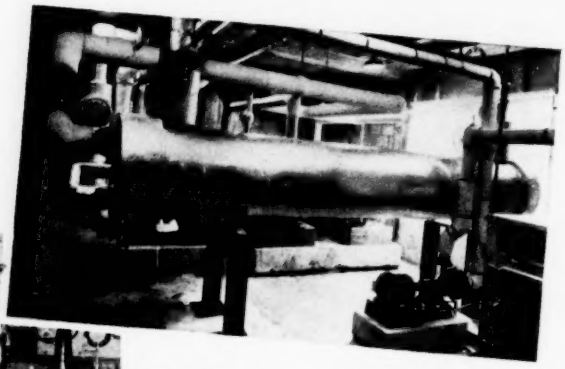
SALES OFFICES • 3165 SOUTH SHIELDS AVENUE • CHICAGO 16

FACTORY, LAPORTE, INDIANA

Even courts decide in favor

Acme AIR CONDITIONING

The Dade County Courthouse in Miami, Florida where an Acme Dry-Ex Water Chiller provides chilled water for the air conditioning system.



270 gallons of water are cooled 12 degrees each minute by this Acme unit.

Acme DRY-EX WATER CHILLER *integral part of Dade County Courthouse Cooling System*

The need was for a unit to provide chilled water for an air conditioning system to offices and court rooms in the Dade County Courthouse in Miami, Florida. The load of 135 tons requires that 270 gallons of water per minute be cooled from 57 degrees Fahrenheit to 45 degrees Fahrenheit with a refrigerant temperature of 40 degrees Fahrenheit. The unit selected was an Acme Dry-Ex Water Chiller. The reasons Acme was selected were: the efficiency and versatility of the Dry-Ex, the added safety features of the Dry-Ex over flooded type chillers, and the close cooperation and good delivery from the local Acme representative and the Acme factory.

In simple words that's the story behind every Acme installation. A need exists, Acme has an efficient, economical unit to fit the need, the customer gets complete cooperation from the whole Acme organization. You should try Acme on your next installation. *Write today for free catalog, Series 631.*

ACME INDUSTRIES, INC.

JACKSON, MICHIGAN

Mfgs. of a complete line of Air Conditioning and Refrigeration Equipment

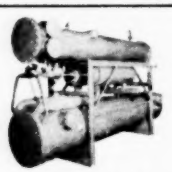
Evaporative Condensers
Cooling Towers
Floor-type Unit Coolers

Direct Expansion (Dry-Ex) and Flooded Liquid Chillers

Heat Exchangers, Oil Separators

Shell and Tube, Shell and Coil Condensers

Receivers, Pipe Coils



Packaged Liquid Chillers to 225 tons

Flow-Temp Heat Pumps

Flow-Cold Liquid Chillers

Remote Room Conditioner

Continuously serving the refrigeration and air conditioning industry since 1919

all in one
Alco Multi-Outlet Thermo Valve

This one simple control does the work of many small valves or expensive distributor headers.

It feeds all circuits equally . . . regardless of load changes.

. . . The entire evaporator always works at peak efficiency. Compressor running time and operating costs are cut.

On many installations, Alco Multi-Outlet Thermo Valves have increased coil capacity up to 35%.

Available for all refrigerants and applications from 2 to 36
Ask for bulletin 180, or if for Ammonia, bulletin 172.

SEE YOUR ALCO WHOLESA

ALCO

ALCO VALVE CO.

859 KINGSLAND AVE. • ST. LOUIS 5, MO.

Designers and Manufacturers of Thermostatic Expansion Valves; Evaporator Pressure Regulators; Solenoid Valves; Float Valves; Float Switches.

5713

Here's Help on Your

Allis-Chalmers application engineering help plus coordinated design of Allis-Chalmers motors, control and *Texrope* V-belt drives saves you engineering and installation expense and time . . . assures a trouble-free job.

AIR CONDITIONING CONTRACTORS LIKE Allis-Chalmers complete drives because they can save money and still assure the customer of a top quality job without service problems. Allis-Chalmers District Office representatives understand the problems of air conditioning contractors and offer them help in engineering exactly the right drive for the application. Since all parts of the Allis-Chalmers drive are of coordinated design and manufacture, they match up and fit together quickly and easily. And buying from a single source is less trouble . . . means that all components arrive on the job together, ready to be installed.

Nation-wide Stocks

Allis-Chalmers District Offices and Authorized Distributors maintain adequate stock of all equipment commonly used in air conditioning installations. No matter where you are located, most items can be delivered within 24 hours. An efficient warehouse inventory system can locate hard-to-get items in a few hours.

Certified Service

Nearly every industrial area in the country has one or more Allis-Chalmers Certified Service Shops . . . independent service shops which meet Allis-Chalmers high standards for modern equipment, efficient methods and business integrity. These shops assure your customer of factory-approved parts and service.

For lower engineering and installation cost . . . for one reliable guarantee of satisfaction on the complete drive unit . . . for quick delivery and top notch service . . . make your next drive Allis-Chalmers.

Send for Free Engineering Literature

Motors

- ☐ Handy Guide to Motor Selection 51B6052
- ☐ Squirrel-Cage Motors 51B6210

Control

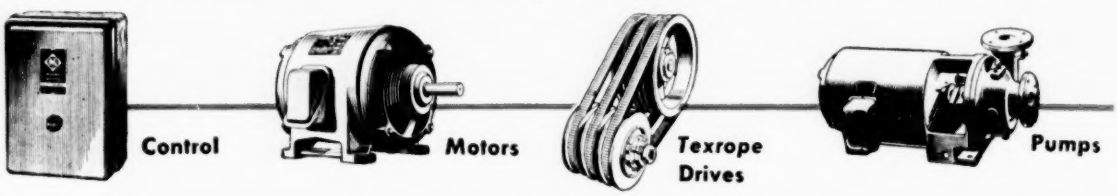
- ☐ Handy Guide to Starters 14B7733
- ☐ Reduced-voltage Starters 14B7215

Texrope Drives

- ☐ Handy Guide to *Texrope* Drives 20B6051
- ☐ *Vari-Pitch* Drive Engineering Data 20B7499

Allis-Chalmers, Milwaukee 1, Wisconsin

COMPLETE SERVICE *from power line to machine*



Drive Problems

Texrope and *Vari-Pitch* are Allis-Chalmers trademarks.

ALLIS-CHALMERS

NO Reducing Valve Needed

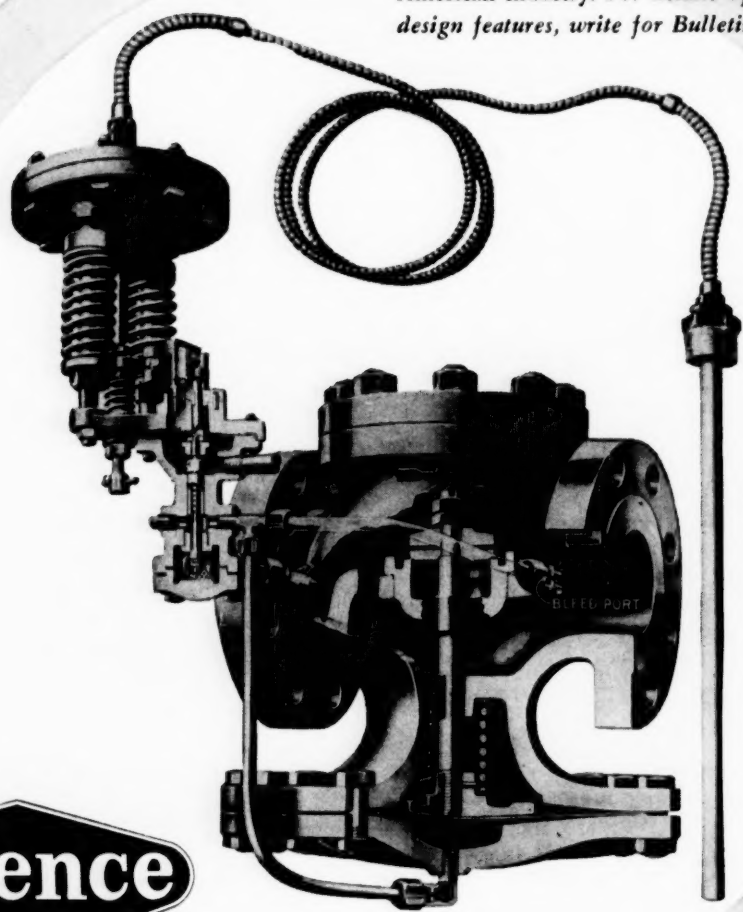
Here's real economy in temperature control.

Because Spence Temperature Regulators are designed to limit heater steam pressures to an adjustable maximum, the need for a separate reducing valve is completely eliminated.

The Spence Regulator takes steam directly from the boiler or high pressure line, reduces the pressure and regulates the flow as required to maintain a constant temperature output from the heater.

This means one relatively small combination pressure and temperature regulator replaces a reducing valve of the same size and a larger temperature regulator. Practically the entire cost of the large separate temperature regulator is saved. And, the total saving would also include the cost of a 3-valve by-pass along with all labor for installation.

This design feature is just one of the reasons for the thousands of Spence installations throughout American industry. *For details of other important design features, write for Bulletin T50.*



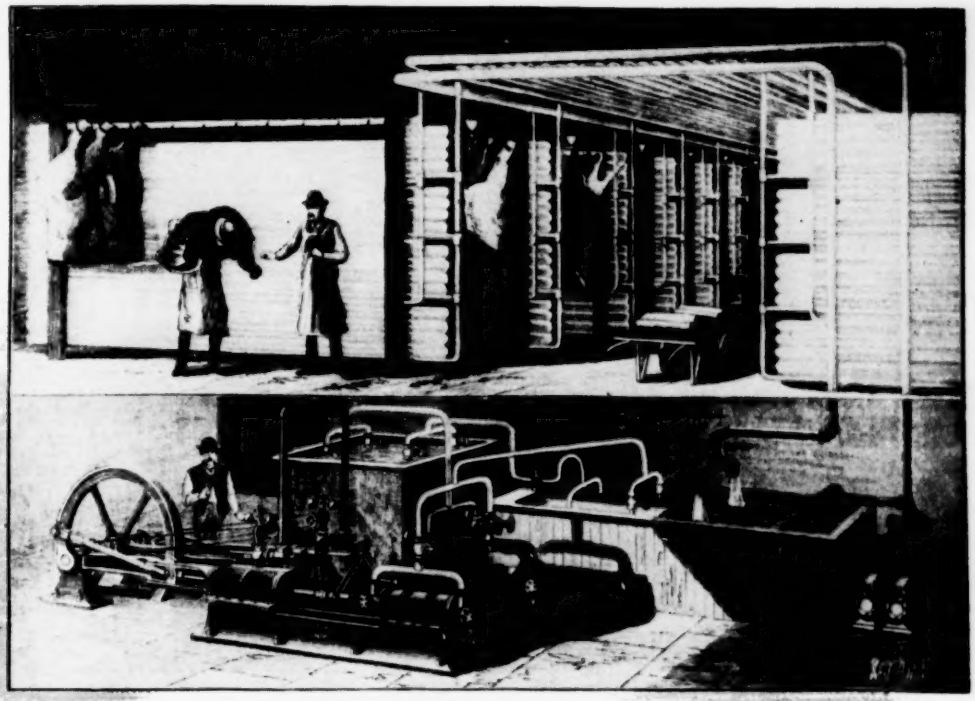
SPENCE
TYPE ET150
Temperature
Regulator

Spence

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

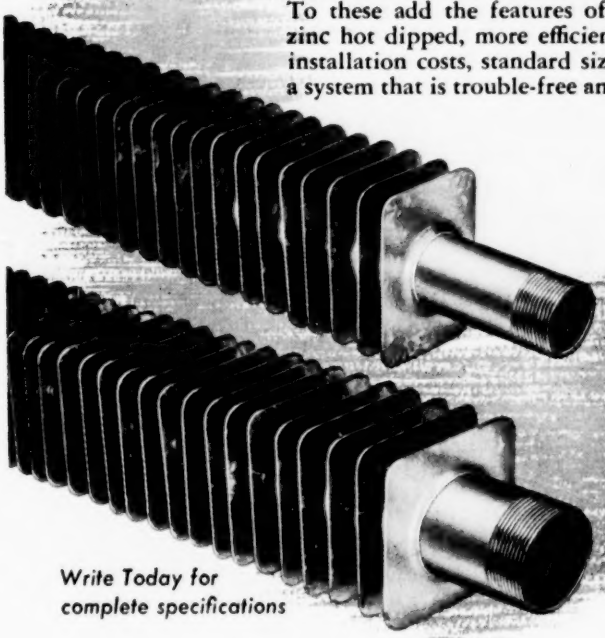
(SE-131)

BETTMANN ARCHIVE



After all these years...

Ammonia and Brine installations have long had many advantageous features . . . a fact well known by the experienced "Ammonia man." Low cost, low volumetric displacement, low weight of liquid circulated and high efficiency made it an ideal refrigerant for early meat packing plants 'way back in 1882 as illustrated above. After all these years those advantages are still important. To these add the features of Bush Finned Pipe . . . all steel construction zinc hot dipped, more efficient air circulation for a gravity type coil, lower installation costs, standard size pipe and heavy gauge fins . . . and you have a system that is trouble-free and efficient.



Write Today for complete specifications

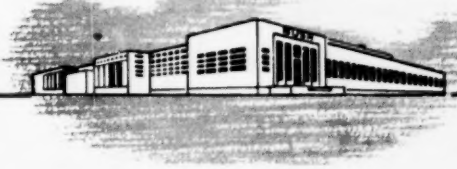
"VG" FIN 3" x 4" ON 1¼" PIPE

FIN SPACING	WEIGHT Per Foot	TOTAL SURFACE Per Lineal Foot	K FACTOR Below Freezing	K FACTOR Above Freezing	BTU/HR. PER LINEAL FT./°F. Below Freezing	BTU/HR. PER LINEAL FT./°F. Above Freezing
3/8"	5.6 lbs.	4.8 sq. ft.	1.2	1.5	5.8	7.2
3/4"	4.0 lbs.	2.6 sq. ft.	1.4	1.7	3.6	4.4
1 1/8"	3.5 lbs.	1.9 sq. ft.	1.5	1.8	2.9	3.4
1 1/2"	3.2 lbs.	1.5 sq. ft.	1.6	2.0	2.4	3.0

"WG" FIN 4" x 4" ON 2" PIPE

FIN SPACING	WEIGHT Per Foot	TOTAL SURFACE Per Lineal Foot	K FACTOR Below Freezing	K FACTOR Above Freezing	BTU/HR. PER LINEAL FT./°F. Below Freezing	BTU/HR. PER LINEAL FT./°F. Above Freezing
3/8"	7.5 lbs.	5.8 sq. ft.	1.2	1.5	7.0	8.7
3/4"	5.7 lbs.	3.2 sq. ft.	1.4	1.7	4.5	5.4
1 1/8"	5.2 lbs.	2.3 sq. ft.	1.5	1.8	3.5	4.1
1 1/2"	4.9 lbs.	1.8 sq. ft.	1.6	2.0	2.9	3.6

Above capacities based on a "T.D." of 20°F.



Bush Manufacturing Company

WEST HARTFORD 10, CONNECTICUT

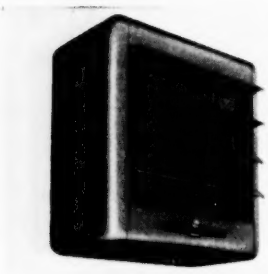
Since 1907

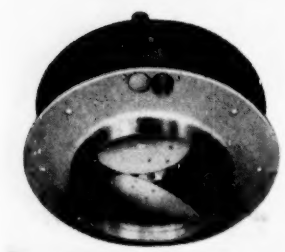
THE latest addition to the famous line of Herman Nelson unit heaters is the GAS FIRED model. The new heater is engineered to precision standards and designed for beauty and utility . . . finished in a smart grey-green baked enamel.

The new heater is operated equally well on all types of natural, manufactured or liquified petroleum gases . . . and it is available in seven sizes with heat input ranging from 25,000 to 200,000 B. T. U.'s per hour.

Another important feature of the new Herman Nelson Gas Fired Unit Heater is its economical installation. No expensive piping or boiler equipment is needed and for this reason it can be moved from place to place and will fit in small spaces.

Write for complete information to HERMAN NELSON HEATING AND VENTILATING PRODUCTS, DEPT. HV-9 AMERICAN AIR FILTER COMPANY, INC., LOUISVILLE 8, KENTUCKY





HORIZONTAL AND VERTICAL UNIT HEATERS

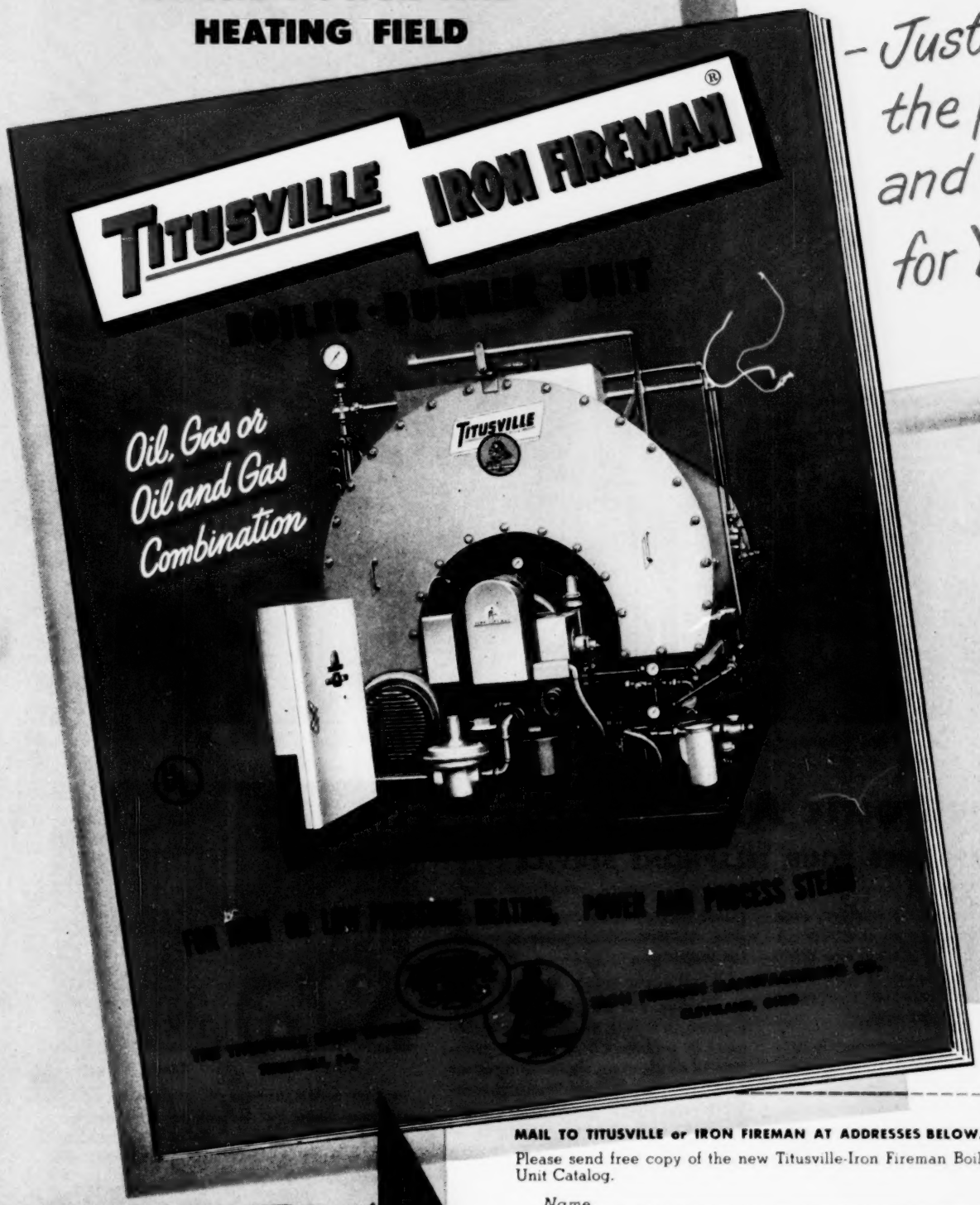
With the addition of the new Gas Fired Heaters . . . the already famous Herman Nelson line offers industry a complete range of models. Our Vertical and Horizontal Units, for operation with either steam or hot water, are available in a wide variety of sizes. These heaters are providing an economical solution to heating problems in thousands of industrial, commercial and institutional buildings where steam or hot water facilities are already available. They provide instant heat . . . *where* and *when* it is needed and *without waste!*

American Air Filter
COMPANY, INC.
215 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P. Q.

AAF
herman nelson

NOW - BIG NEWS

IN THE POWER AND HEATING FIELD



– Just off the press and ready for YOU!

MAIL THIS COUPON *Today!*

Fully illustrated, colorful 12-page catalog contains complete data and specifications on models, sizes, capacities, operation and advantages of the new Titusville-Iron Fireman Boiler-Burner Unit. This catalog yours without cost or obligation. Send coupon to Titusville Iron Works Co. or Iron Fireman Manufacturing Co.

MAIL TO TITUSVILLE or IRON FIREMAN AT ADDRESSES BELOW.

Please send free copy of the new Titusville-Iron Fireman Boiler-Burner Unit Catalog.

Name _____

Company _____

Street Address _____

City, Zone, State _____

Iron Fireman Mfg. Co.
3074 West 106 Street,
Cleveland 11, Ohio

Titusville Iron Works
313 S. Franklin St., Titusville, Pa.
Division of Struthers Wells Corp.

Putting Air to Work For Bell Telephone: delicate relays and switches thrive on dirt-free air.

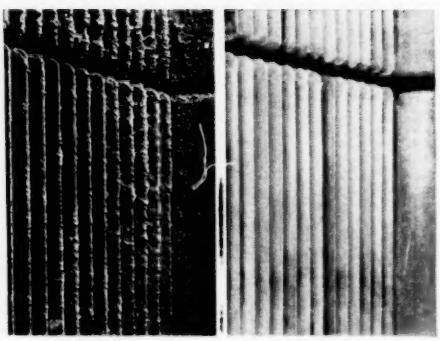
Electronic Air Cleaning

IMPROVES YOUR TELEPHONE SERVICE

Every time you dial a number, over 900 tiny contacts are set in motion. A speck of dirt in any of them may delay your call, so offices must be kept clean. That's why Bell gives their equipment the "kid glove" treatment.

In many Bell System exchanges in centers of heavy industry, Westinghouse PRECIPITRON®, the electronic air cleaner, keeps air at its highest purity. It traps the fine particles of dust and dirt which pass right through conventional filters. Result: better service for you; reduced maintenance costs for the exchange.

Chances are airborne dirt is costing *you* money. For example, in cleaning expense, in rejects, in damage to equipment or processes. For help on problems of air cleaning, air handling or air conditioning call your Westinghouse-Sturtevant office. Westinghouse Electric Corp., Sturtevant Division, Hyde Park, Boston 36, Mass.



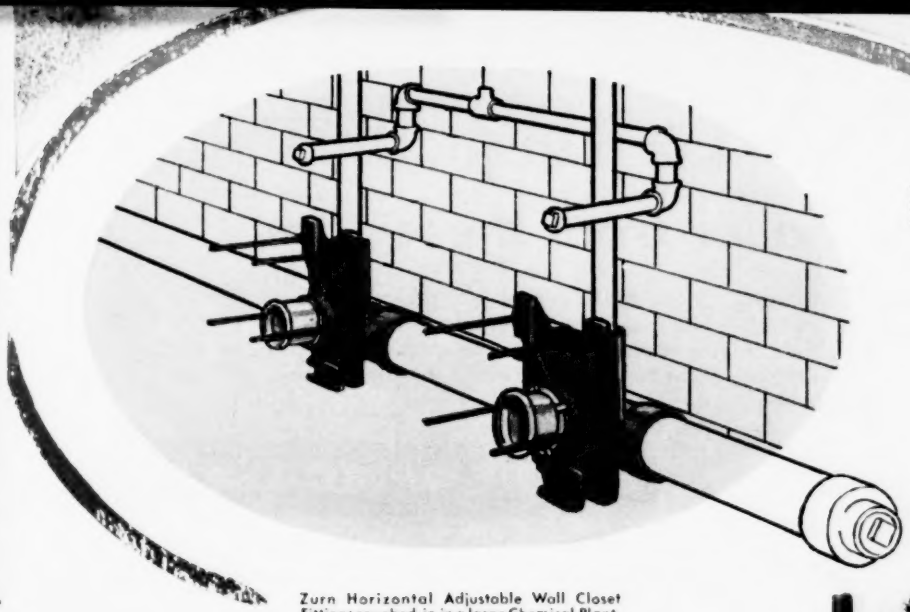
Dirty Plates **Clean Plates**

PRECIPITRON is the most efficient commercial air cleaner available. All dirt particles receive an electric charge, are attracted and cling to collector plates of opposite polarity. Periodically they are flushed down the drain.

Photo above left shows amount of dirt collected on PRECIPITRON plates after 2½ weeks. Photo at right shows plates after cleaning.

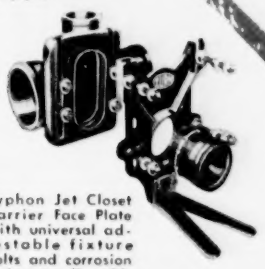
WESTINGHOUSE AIR HANDLING

YOU CAN BE SURE ... IF IT'S Westinghouse J-80319



Zurn Horizontal Adjustable Wall Closet Fittings roughed-in in a large Chemical Plant.

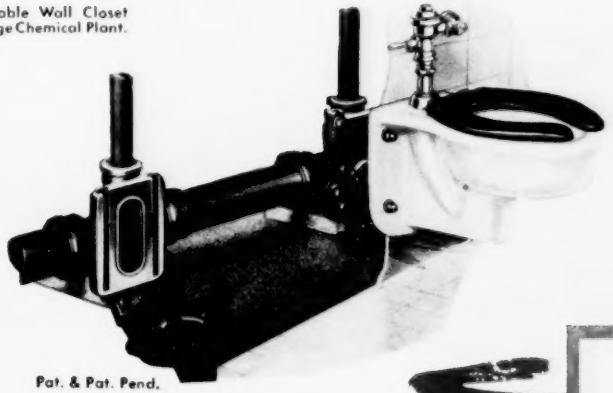
Wall Closet Fitting — horizontal, single type shown with connection for soil pipe.



Syphon Jet Closet Carrier Face Plate with universal adjustable fixture bolts and corrosion resistant adjustable coupling.

Exploded view of Zurn Wall Closet Fitting for syphon jet closet left-hand, horizontal, for soil pipe connections. Also available for threaded pipe connection.

A ZURN system*



Pat. & Pat. Pend.

simplifies fixture installations ...usually reduces time costs!

A Zurn System includes everything for installing wall-type toilets up to where the horizontal drainage line connects with the stack, except the pipe. Installations are above the floor, behind the toilets, behind the wall. There are no delays waiting for other crafts.

The flexibility of a Zurn System for installing wall-type fixtures assures speed in assembly and accurate alignment in all three directions during installation; rigid water-tight connections insure minimum final adjustments when installing wall-type toilets; bulk of assembly can be precut in shop; unique waterway allowing a 4" vertical adjustment does away with numbered fittings.

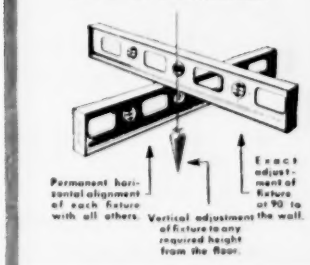
A Zurn System is available for any make of wall-type plumbing fixture and can be assembled into an almost limitless variety of installations for any type of building including apartments. Write for free booklet, "You Can Build It and Maintain It for Less A NEW WAY."

*T. M. Reg. U. S. Pat. Off.

THE WAY

PERFECT ALIGNMENT IN ALL 3 DIRECTIONS

Obtained with Exclusive Adjustment Features of Zurn Wall Closet Fittings And Carriers... For The Support of All Types And Makes of Wall Type Fixtures


Permanent horizontal alignment of each fixture with all others.
Vertical adjustment of fixture to any required height from the floor.
Exact adjustment of fixture at 90° to the wall.

Over 500,000 Wall-Type Fixtures Now Installed with ZURN SYSTEMS in Buildings of Every Type from Coast to Coast. Write for list of buildings having rest rooms with fixture-bare floors.

J. A. ZURN MFG. CO. PLUMBING DIVISION • ERIE, PA., U.S.A.

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Sales Offices in All Principal Cities

***In Canada:* Canadian Zurn Engineering Ltd., Montreal, P. Q.**

ZURN

PLUMBING DIVISION PRODUCTS INCLUDE EVERYTHING FOR DRAINAGE SYSTEMS FROM ROOF TO BASEMENT

Grease Interceptor | Area Floor Drain | Roof Drain with Internal Expansion Joint; High velocity drainage | Backwater Valve Non-fouling | Supreme Perfect Seal Floor Level Cleanout | One of Several types of Zurn Carriers for wall-type urinals

J. A. ZURN MFG. CO.
PLUMBING DIVISION
ERIE, PA., U. S. A.

Please send me the new Zurn booklet, "You Can Build It and Maintain It for Less A NEW WAY."

Name and Title .....

Company .....

Street .....

City and State .....

Please attach coupon to your business letterhead.

Dept. HV

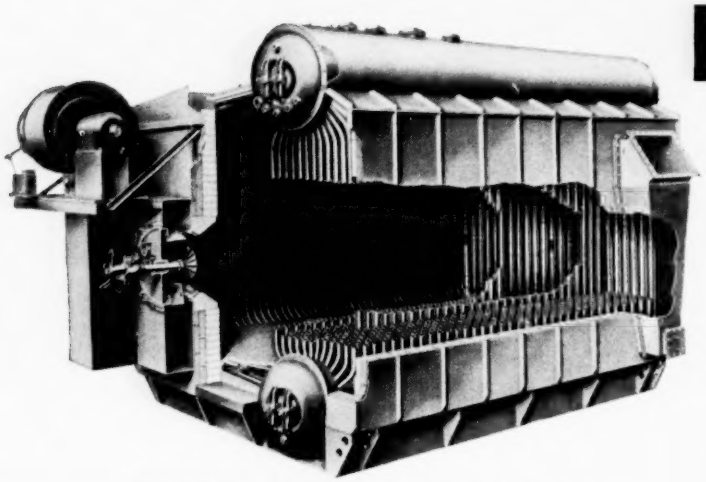
FOR STEAM CAPACITY up to 60,000 POUNDS

Choose your boiler from these two

If you burn oil or gas, investigate the VP Package Boiler for capacities up to 30,000 pounds per hr . . . the VU-10 up to 60,000 pounds.

For stoker firing, the VU-10 is available from 10,000 to 60,000 pounds of steam per hour.

Whatever your fuel . . . whatever your steam capacity requirements up to 60,000 pounds per hour — you'll find that one of the Combustion Engineering Boilers described below will be just right for you.



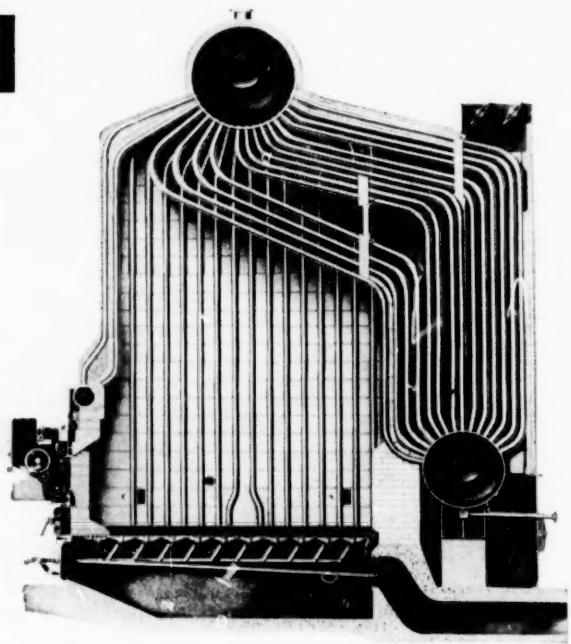
The VP Boiler — the Package Boiler with EXTRA Features

THE VP BOILER

The C-E Package Boiler, type VP . . . completely shop-assembled . . . for oil or gas firing. It is available in capacities from 4,000 to 30,000 lb steam per hr; for pressures to 250 psi. The VP Boiler has more water-cooled area per cubic foot of furnace volume than any other boiler of its size and type. The large (30-in. diameter) lower drum permits a simple, symmetrical tube arrangement . . . greater water storage capacity . . . easy access for washing down or inspection. The centrifugal fan is efficient, yet its noise level is less than half that of typical high-speed blowers used on most package boilers. Baffle arrangement is simple, resulting in low draft loss . . . simple soot blowing . . . elimination of dead pockets . . . high heat absorption.

THE VU-10 BOILER

The VU-10 Boiler is designed for industrial load conditions, particularly for plants with small operating and maintenance forces. Capacities range from 10,000 to 60,000 lb steam per hr . . . pressures to 475 psi . . . heat recovery equipment is available if desired. Fuel can be either coal (C-E Spreader, Traveling Grate or Underfeed Stoker) oil or gas. This boiler is a completely standarized design adaptable to many conditions. It responds readily to variations in load; it is simple to operate and maintain. All parts are easily accessible for inspection. Like the VP, the VU-10 Boiler is a complete unit — boiler, furnace setting, fuel-burning equipment, controls, forced draft — bringing you the benefit of one contract . . . one guarantee . . . one responsibility.



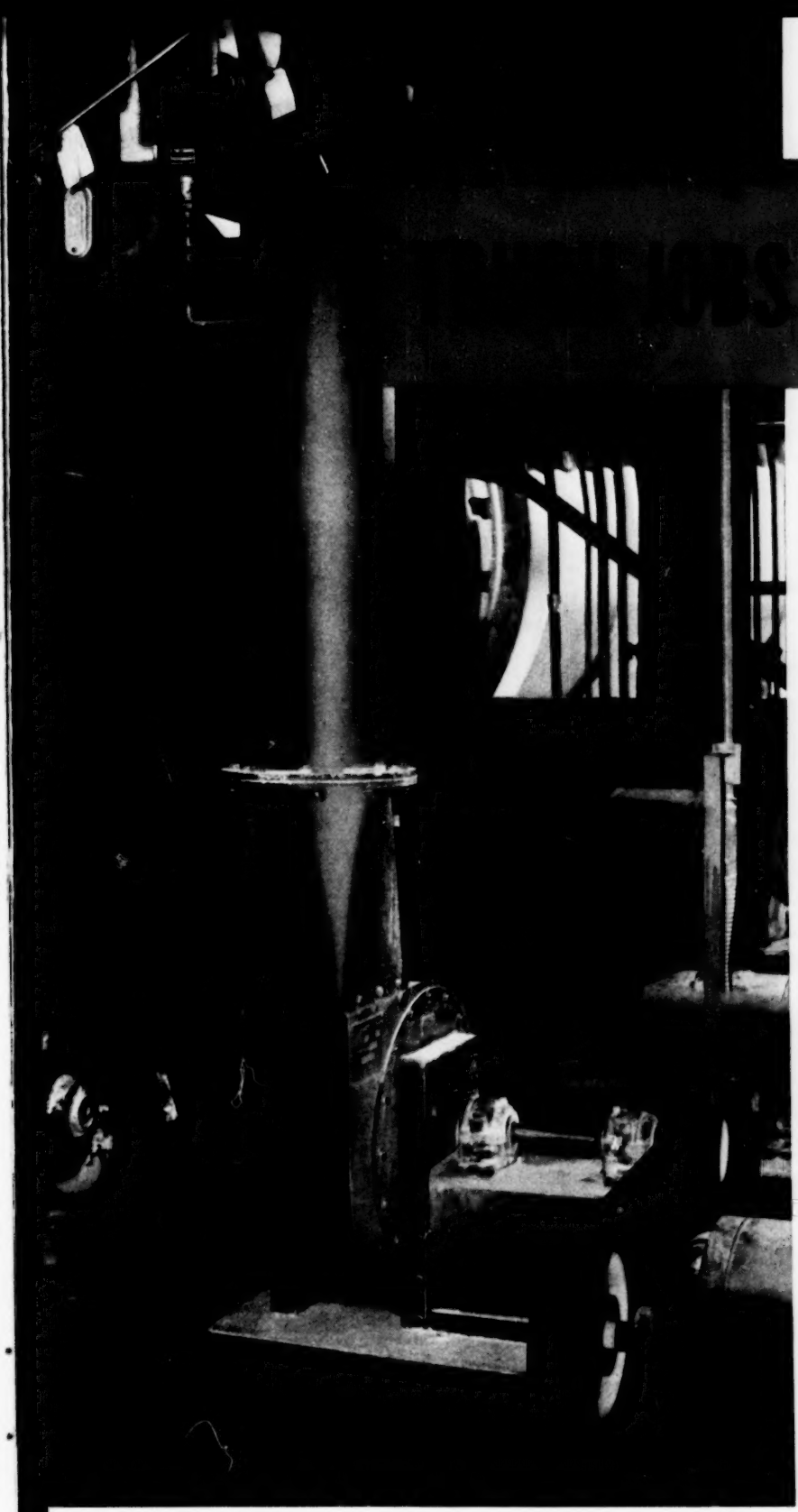
The VU-10 Boiler, as arranged for C-E Spreader Stoker firing

COMBUSTION ENGINEERING, Inc.

Combustion Engineering Building • 200 Madison Avenue, New York 16, N. Y.

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT

B-689B



like these rugged INDUSTRIAL EXHAUSTERS

Supplying primary and secondary air for a lime kiln is a job calling for constant pressure and twenty-four hour reliability. "Buffalo" Industrial Exhausters have proven themselves ideal for such service. All-welded heavy steel plate housings and rotors give them ample strength and rigidity. Note the extra-heavy shafts and large bearings to take the torque and thrust. Available with either Material Wheels or Air Wheels, these fans have earned a reputation as the "work fans of industry," on every type of exhaust and pneumatic conveying job, as well as mechanical draft.

"Buffalo" Industrial Exhausters may be had in high-heat models, rubber-lined, coated or alloy construction for handling corrosive and/or abrasive atmospheres.

For fans that will perform as rated, and that will stand up on the job, specify "Buffalo." Why not write for recommendations on *your* air application?

FIRST FOR FANS

BUFFALO "Buffalo" FORGE COMPANY

480 BROADWAY BUFFALO, NEW YORK

PUBLISHERS OF "FAN ENGINEERING" HANDBOOK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

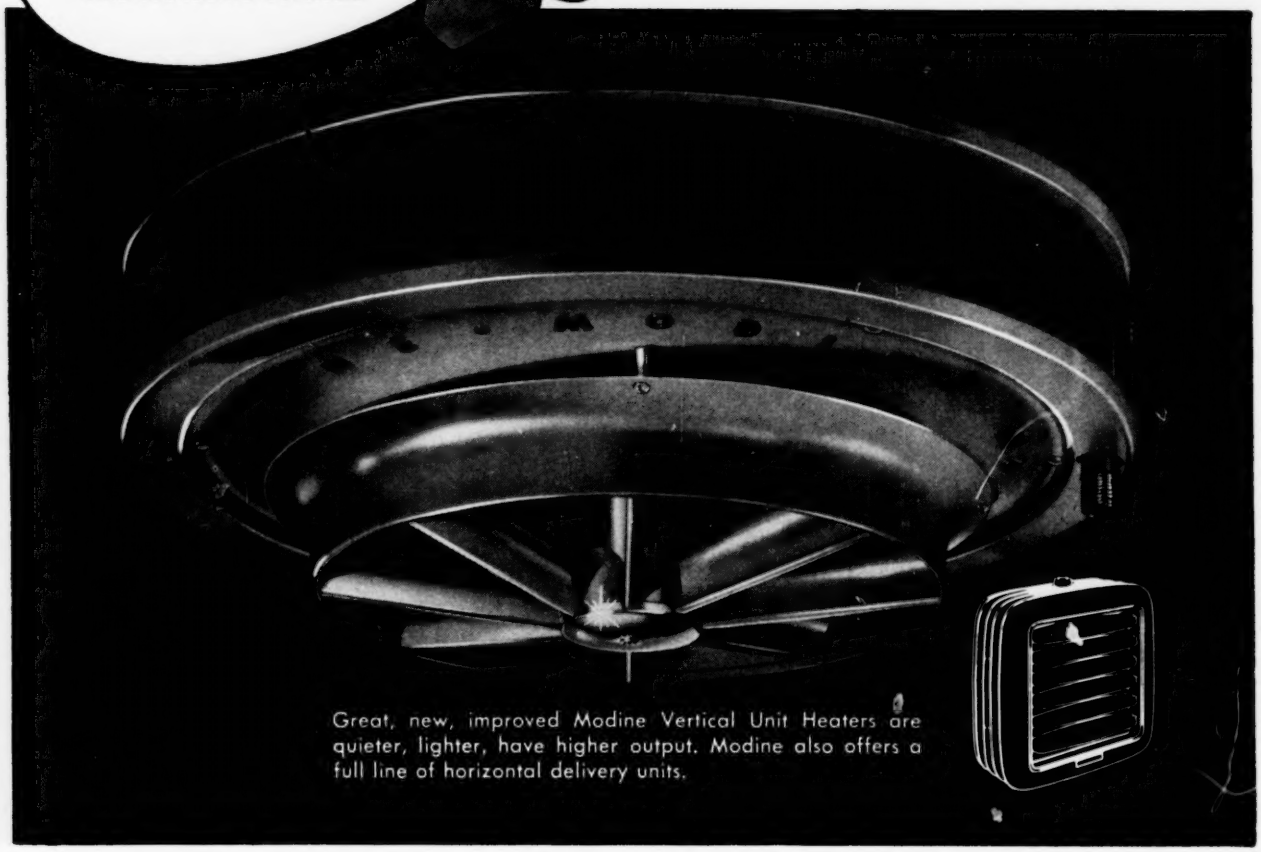
VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING
FORCED DRAFT COOLING HEATING PRESSURE BLOWING

When you buy steam, hot water

STEAM OR HOT WATER UNITS

—featuring a great, new line of Modine Verticals

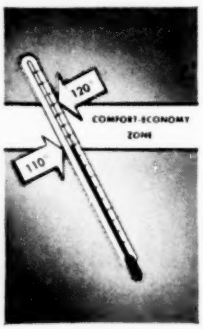
LOOK 'EM



Great, new, improved Modine Vertical Unit Heaters are quieter, lighter, have higher output. Modine also offers a full line of horizontal delivery units.

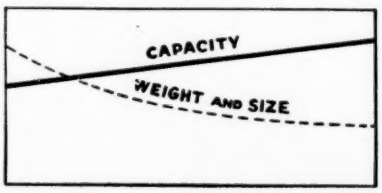
LOOK FOR CORRECT DISCHARGE TEMPERATURES

New Modine Verticals give you discharge air temperatures of 110° to 120° F. correctly related to air velocities. This combination is the key to perfect heating comfort plus lower fuel costs for you.



LOOK FOR GREATER CAPACITY — LIGHTER WEIGHT — LOWER INSTALLED COST

New Modine Verticals provide greater heating capacity because of new high efficiency condenser design. Yet, these *stepped-up* Modines weigh far less, are easier to handle, cost less to install.



LOOK FOR THE BROADER LINE

You have more sizes to choose from when you choose new Modine Verticals. This means it is easier for you to meet specific temperature, air delivery, and location requirements. *But see for yourself!* Call the Modine representative listed in your phone book or write for Bulletin 153 on Modine Steam and Hot Water Unit Heaters today.

or gas-fired unit heaters....

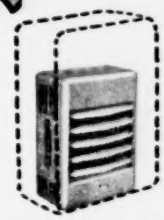
ALL OVER!

GAS-FIRED UNITS

— Only Modine has stainless steel heat exchangers *and* burners

Modine Gas-Fired Unit Heaters are built in a full line of popular sizes. All are A.G.A.-approved for natural, mixed, manufactured, L.P. and L.P.-air gases.

LOOK FOR EASY INSTALLATION



Advanced stainless design makes Modines 50% lighter in weight — more compact — than the average of seven other leading makes. Installation is faster, easier — no need for special structural supports. On one job, it cost the heating contractor $600 less to install 66 Modines than conventional units — savings he passed on to the owner.

LOOK FOR TOP PERFORMANCE

Not only do Modine units resist corrosion—all tubes heat uniformly because they're individually fired. Burners have elongated ports with four times the free area of ordinary drilled ports for maximum combustion efficiency. Remember: with Modines you are *sure* of getting full rated capacity.

LOOK FOR ALL-AROUND VALUE

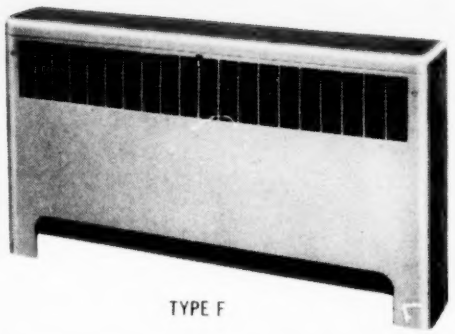
As the leader in the development and application of steam and hot water unit heaters for more than 25 years, Modine brings unequalled experience to gas unit heating problems. It is the only manufacturer to publish heat throw data for gas-fired units. For facts, ask for Bulletin 653. Modine Mfg. Co., 1511 DeKoven Avenue, Racine, Wisconsin.

U-1203

Modine UNIT HEATERS

1350 Lakeshore Drive Apartments, Chicago

Loebl, Schlossman & Bennett—Architects
Samuel R. Lewis & Associates—Consulting Engineers
M. J. Holleran—Plumbing & Heating Contractor
S. N. Nielsen Company—General Contractor
Draper & Kramer, Inc.—Managing Agents



TYPE F

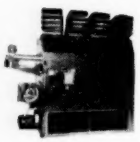
740 ULTRA-MODERN LIVING UNITS COMFORTABLY HEATED

By *Airtherm* CONVECTORS

The clean, modern beauty of Airtherm Convectors fits perfectly into these functional interiors. Outstanding performance and easy maintenance make Airtherm Convectors exceptionally practical for this huge apartment project. To help you solve a wide range of heating problems Airtherm Convectors are available for wall, recessed or free-standing installation.

For Heating Satisfaction . . .
Think First of

Airtherm



Oil or Gas Direct Fired Heaters

Horizontal Type Unit Heaters

Vertical Type Unit Heaters

Centrifugal Fan Unit Heaters

Ask Your Wholesaler or Write

AIRTHERM MANUFACTURING COMPANY
722 South Spring Avenue • St. Louis 10, Missouri

LOOK WHAT'S HAPPENING IN YOUR COOLING TOWER

HERE'S WHY KOPPERS PRESSURE CREOSOTING ON HALSTEAD & MITCHELL COOLING TOWERS IS VITAL FOR LONG LIFE

WHY CREOSOTED WOOD?

Rough-cut wood simply "wets" more effectively than any other suitable material. Constantly wetted wood is subject to immediate attack by fungus and marine parasites. Creosote is the most permanent and positive preservative for timber . . . *containing 162 elements* toxic to fungus growth and parasites . . . proved by over 100 years of use. All wood used in Halstead & Mitchell Cooling Towers is pressure-creosoted.

WHY KOPPERS PRESSURE-CREOSOTING?

Wood preservatives must penetrate deeply to be effective; a surface coating can be worn or broken through and the wood is then under immediate attack. Koppers Pressure-Creosoting gives the deepest possible penetration and longest possible life. Therefore, Halstead & Mitchell wetted decks are Koppers Pressure-Creosoted.

ONLY HALSTEAD & MITCHELL OFFERS THE

20-Year Guarantee!

ON THE WETTED DECK SURFACE

against rotting by fungus attack

2 thru 100 Tons

Sheet-Steel Cabinets,
3-times protected
Stainless Steel Fans and Shafts
Weather Shielding
Gravity-Type Distributing Pans
—no windage loss
Everdur Bolts for ease of
disassembly at any time.

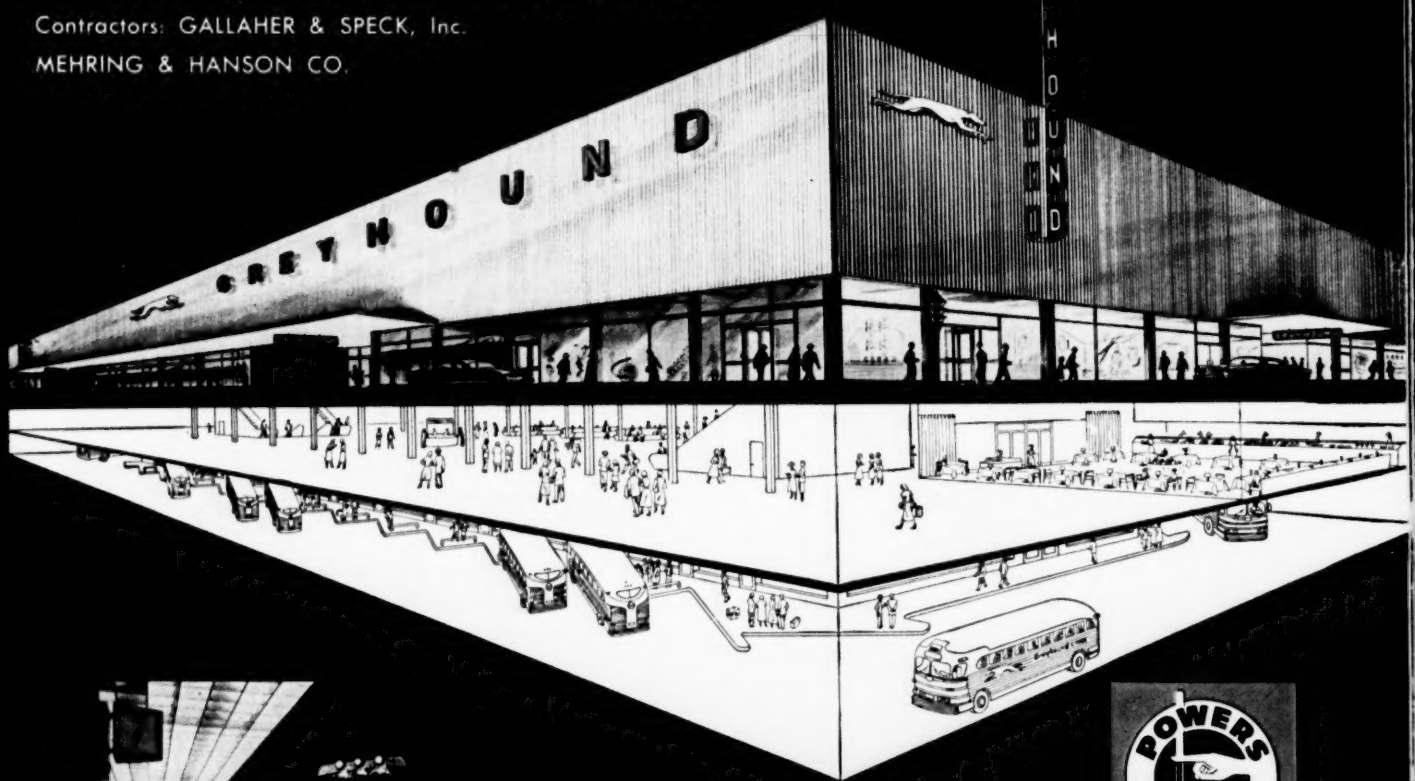
Write for Catalogs

HM Halstead & Mitchell

OFFICES: Bessemer Bldg., Pittsburgh 22, Pa.

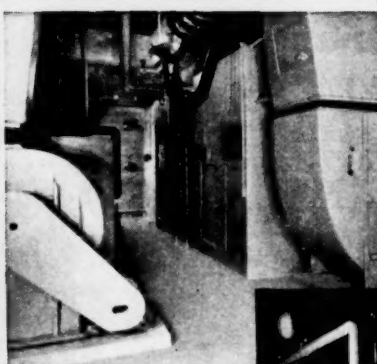
Air Conditioned Comfort

Architects and Engineers: SKIDMORE, OWINGS & MERRILL
Contractors: GALLAHER & SPECK, Inc.
MEHRING & HANSON CO.

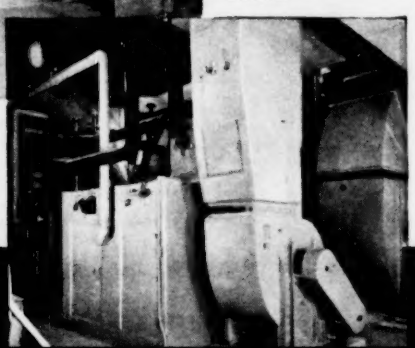


POWERS CONTROL

Above:
18 Smoke Vent Louvre Dampers in Bus Loading Concourse are controlled by 6" POWERSTROKE motors.

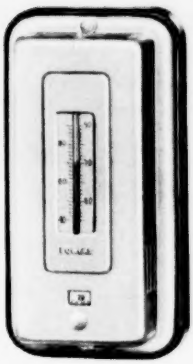


Some of the more than 20 supply and exhaust fans with a total capacity of 500,000 cfm which are Powers controlled.



in Biggest Privately Owned Bus Terminal is assured by a

POWERS PNEUMATIC SYSTEM OF *Control*



Type D Thermostat

Greyhound Corporation's new up-to-the-minute $10 million bus terminal in Chicago is completely air conditioned. The two million passengers yearly, estimated to use this building, will find every modern convenience and comfort.

On the top two levels, is a public parking space for 500 autos. On the street level and the waiting room level are 13 stores and shops, 7 restaurants and other spaces, which are air conditioned and Powers controlled.

On the bottom level is the Bus Loading Concourse with 31 platforms for arriving and departing buses. Its ventilating system has a capacity of 180,000 cfm which creates a continuous 5 mph breeze. Here 18 Smoke Vent Louvre Dampers are controlled by 6" POWERSTROKE motors. In case of emergency the dampers can be opened by 3 manually operated positive switches each strategically located in a glass covered cabinet.

Domestic Hot Water Supply for the building is furnished by steam heated storage heaters controlled by Powers No. 11 Temperature Regulators. Shower Baths thruout the building are each regulated by a Powers Thermostatic Water Mixer.

Experience gained by Powers here and in many other important large and small buildings will be helpful to you. Next time a temperature or humidity control problem arises, contact POWERS nearest office. There's no obligation.

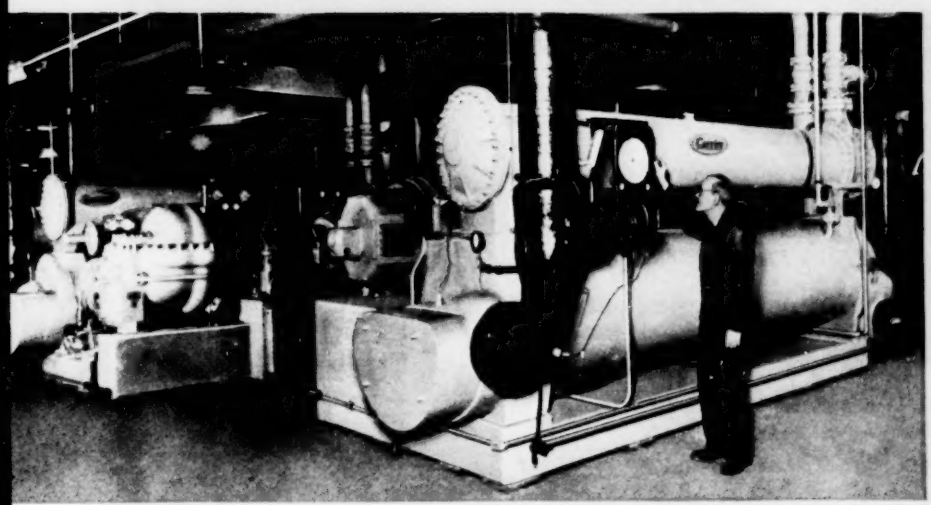
THE POWERS REGULATOR CO.

Skokie, Ill. • Offices in Over 50 Cities in the U.S.A., Canada and Mexico

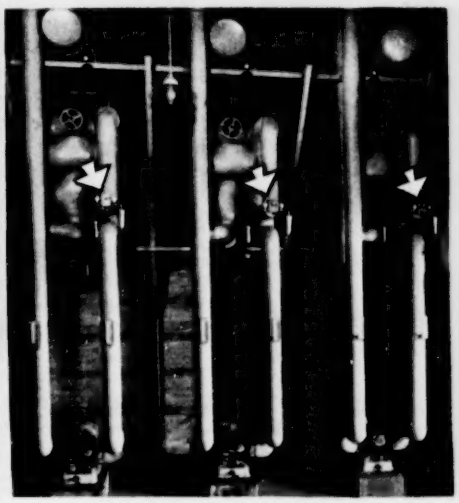
See Your Phone Book

OVER 60 YEARS OF AUTOMATIC TEMPERATURE CONTROL

(b16)

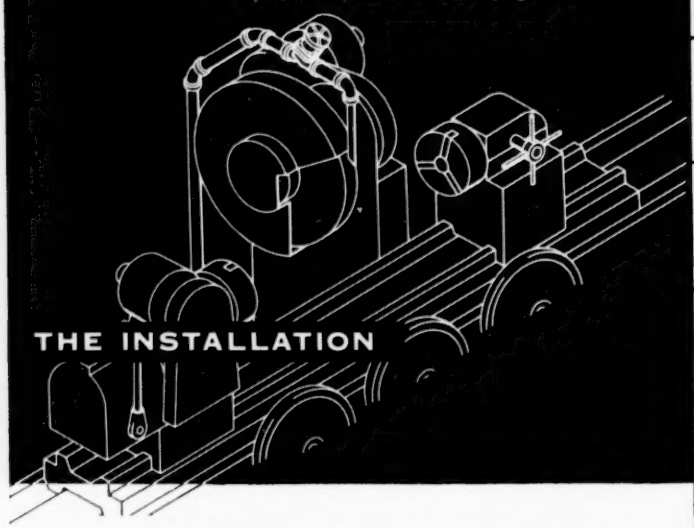


Mr. Henry Burckert, Chief Engineer inspecting one of the two Powers Series 100 Recording-Controllers on two Centrifigul Refrigerating Compressors (610 Ton Cap.) supplying chilled water for air conditioning.



Nine Powers ACCRITEM Regulators above operate FLOWRITE diaphragm valves which control chilled water in summer and hot water in winter supplied to individual coils throughout the building.

How this Valve Solved a Costly Problem ... on Abrasive Fluid, for instance



THE INSTALLATION

At Standard Crankshaft & Hydraulic Co., Inc., Charlotte, N. C., with Crane diaphragm valves on regrinding machines, controlling flow of grinding solution to the work.

VALVE SERVICE RATINGS

SUITABILITY:
Far better than expected

FEATURES:
Pliable Neoprene disc insert

MAINTENANCE COST:
Zero

SERVICE LIFE:
Now 8 times longer than other valves

OPERATING RESULTS:
Forced machine down time stopped

AVAILABILITY:
Crane catalog item—No. 1610

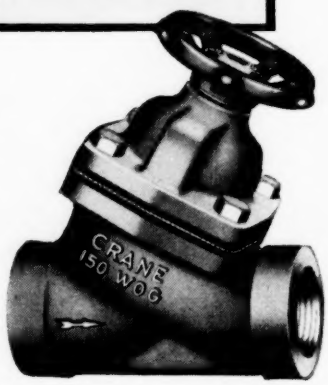
THE CASE HISTORY

About 3 weeks was the maximum service life of the conventional globe valves formerly on these machines. Their disc and seat were quickly cut out by the abrasive and steel dust that mixed with the re-circulated lubricant. Keeping up with replacements was costly in valves as well as extended machine down time.

Crane 1610 Diaphragm Valves were selected to help if not remedy the situation. They would last longer. Their pliable Neoprene disc insert would absorb the foreign particles that cause leakage and wire-drawing in ordinary valves. And when needed, a disc could be renewed in a few minutes.

But results were far better than expected. The Crane valves installed more than 6 months ago are still in service with no repairs; show no sign of trouble. Naturally, these valves have been put on all grinders.

THE VALVE



Neoprene disc insert seating is but one feature of Crane Packless Diaphragm Valves. Their sealed bonnet isolates working parts from line fluid. Independent disc and diaphragm design reduces diaphragm wear; permits closure on fluid even should diaphragm fail. These valves come in many body and trim materials for corrosive, abrasive, or common services. See your Crane Catalog or Crane Representative.

THE BETTER QUALITY...BIGGER VALUE LINE...IN BRASS, STEEL, IRON

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

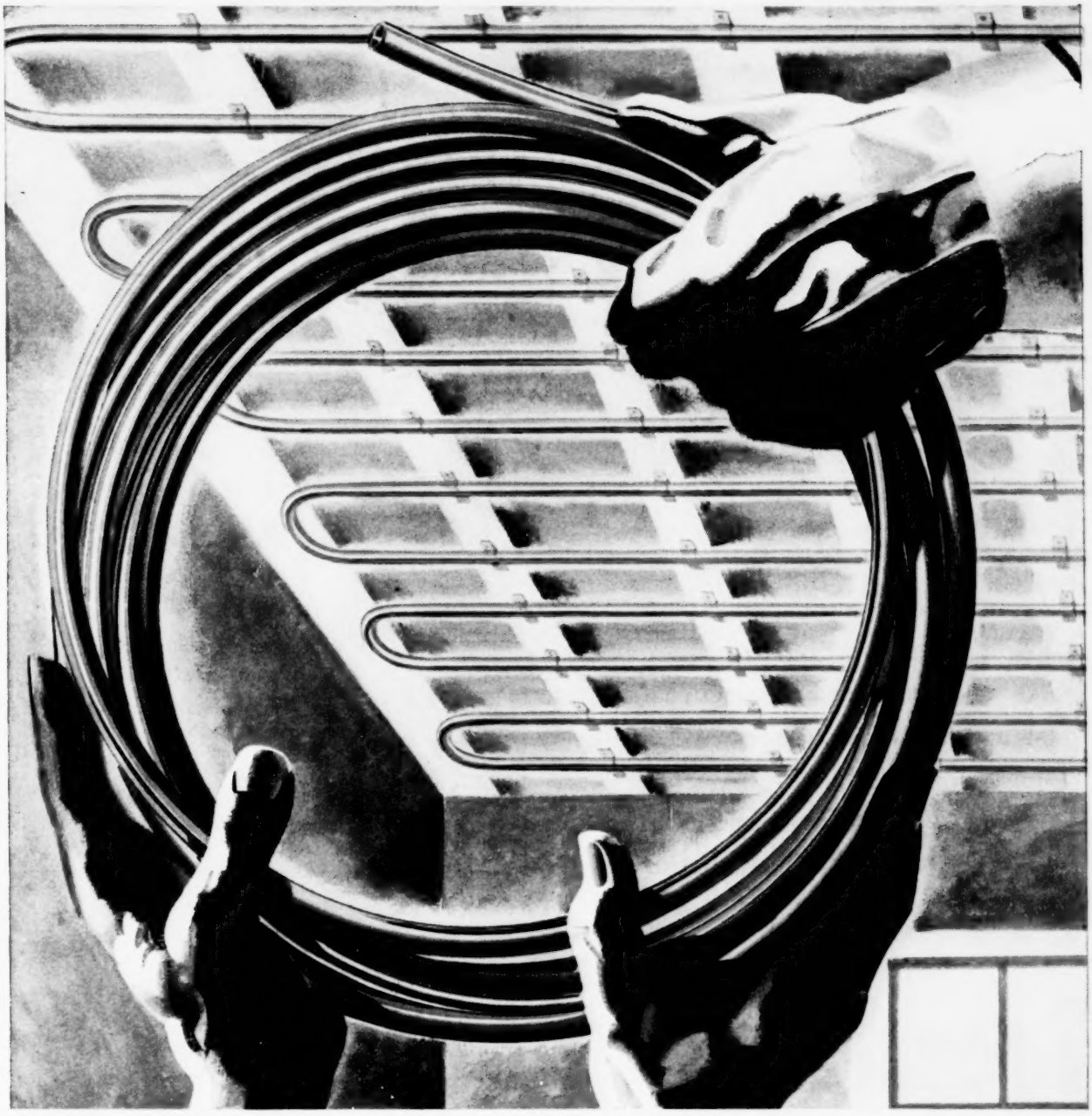
FOR RADIANT HEATING

choose handy, lightweight

CHASE® COPPER TUBE

CHASE

Small outside diameters make Chase lightweight Copper Tube perfect for ceiling, floor and wall installations. Easy-bending long lengths mean fewer joints . . . joints that are a cinch to make with leak-proof Chase Solder-Joint Fittings. And, of course, you get all the superior qualities of Copper: long service, excellent thermal conductivity, corrosion resistance. Why not write today for Free 50-page Book giving important information on Radiant Panel Heating!



Chase BRASS & COPPER

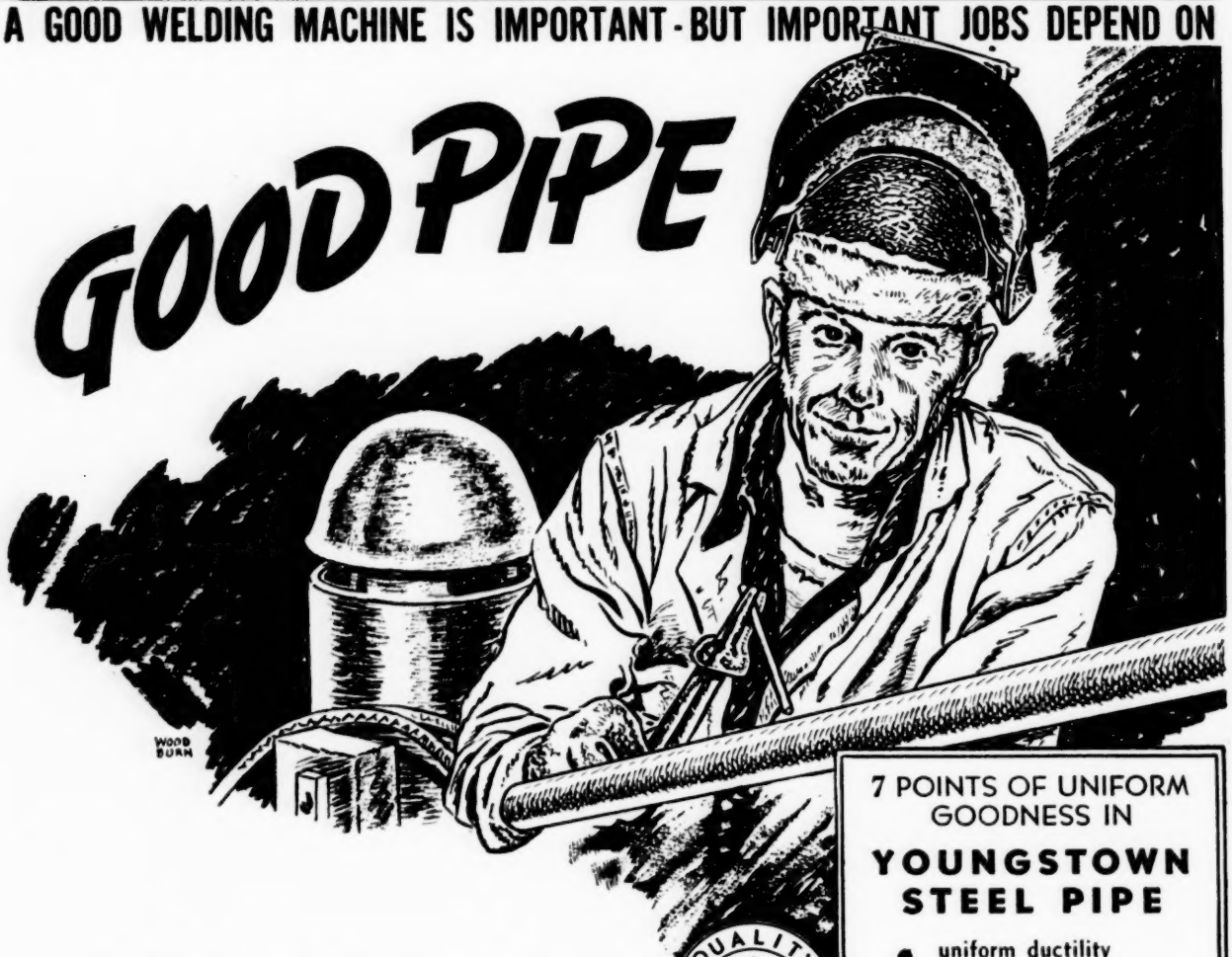
WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

The Nation's Headquarters for Brass & Copper

Albany †	Cleveland	Kansas City, Mo.	New York	San Francisco
Atlanta	Dallas	Los Angeles	Philadelphia	Seattle
Baltimore	Denver †	Milwaukee	Pittsburgh	Waterbury
Boston	Detroit	Minneapolis	Providence	
Chicago	Houston	Newark	Rochester †	(† sales
Cincinnati	Indianapolis	New Orleans	St. Louis	office only)

A GOOD WELDING MACHINE IS IMPORTANT - BUT IMPORTANT JOBS DEPEND ON

GOOD PIPE



QUALITY
YOUNGSTOWN
SERVICE

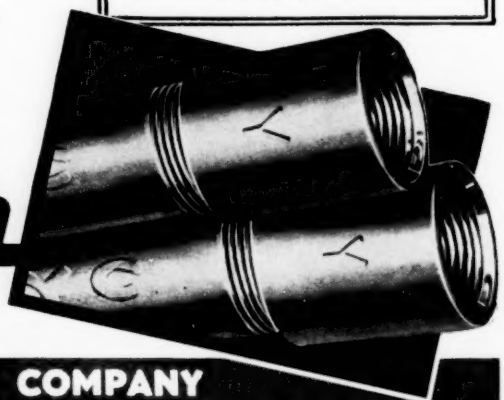
NO matter how intricate the weld, you do it readily with Youngstown pipe.

That's because Youngstown pipe is designed and made for easy welding—truly round, uniform in wall thickness, uniformly sized, and chemically and metallurgically right. The name "Youngstown" rolled into a length of pipe means it is GOOD PIPE.

7 POINTS OF UNIFORM GOODNESS IN

YOUNGSTOWN STEEL PIPE

- uniform ductility
- uniform lengths
- uniform threading
- uniform weldability
- uniform wall thickness and size
- uniform strength and toughness
- uniform roundness and straightness



Youngstown STEEL PIPE

THE YOUNGSTOWN SHEET AND TUBE COMPANY

General Offices: Youngstown, Ohio - Export Office: 500 Fifth Avenue, New York 36, N. Y.

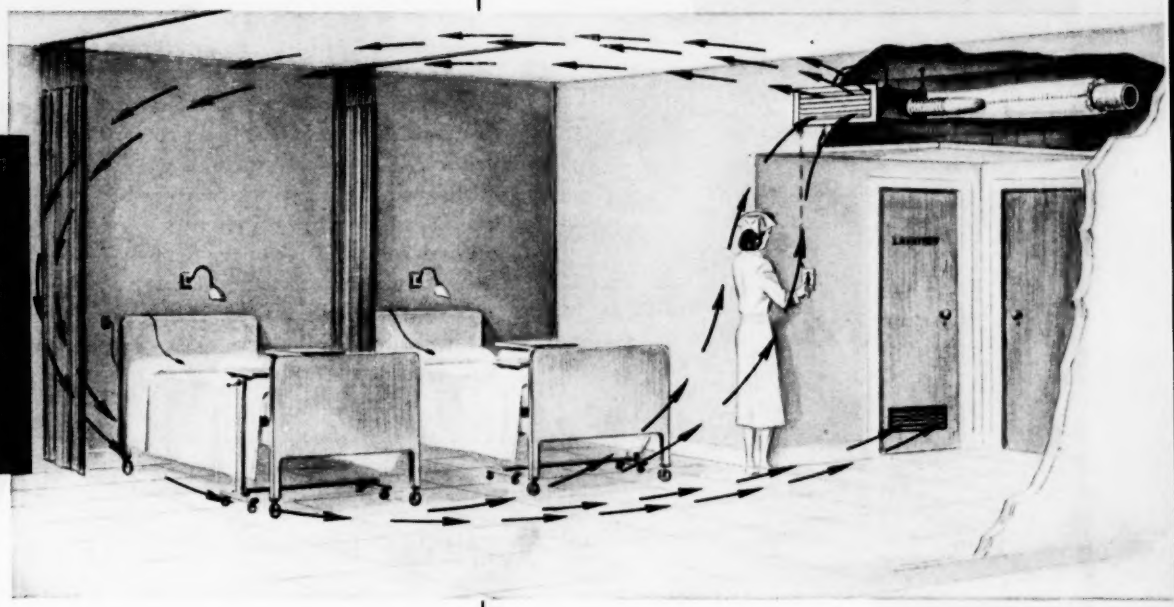
PIPE AND TUBULAR PRODUCTS - CONDUIT - BARS - RODS - COLD FINISHED CARBON AND ALLOY BARS - SHEETS - PLATES - WIRE - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - RAILROAD TRACK SPIKES

Just what the doctor ordered

Anemostat Units for

HIGH VELOCITY

Air Conditioning Systems



For useful engineering data on high velocity, write today for your copy of HV Manual 48.

The illustration shows a typical **hospital** room installation of an Anemostat high velocity unit in the HPSL-100 series. These induction-type units induce into the device a volume of room air up to 100% of the primary air supply according to requirements. They are made for single or dual duct systems, have manual or automatic controls, and may be installed in walls or ceilings.

You will find these units ideally suited not only for hospitals, but also for hotels, offices and similar installations—in new as well as old buildings.

ANEMOSTAT®

DRAFTLESS *Aspirating* **AIR DIFFUSERS**

ANEMOSTAT CORPORATION OF AMERICA

10 EAST 39th STREET, NEW YORK 16, N. Y.

REPRESENTATIVES IN PRINCIPAL CITIES

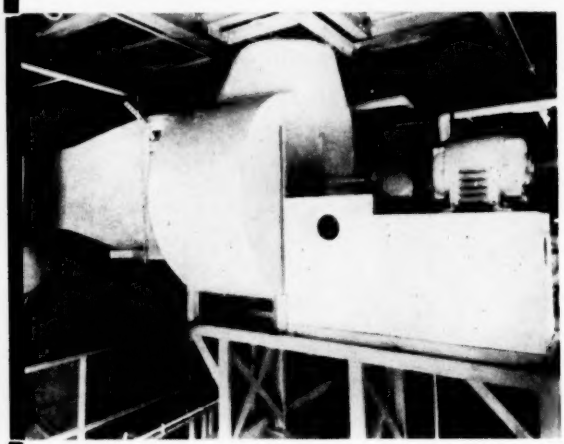
"No Air Conditioning System Is Better Than Its Air Distribution"

GENERAL BLOWER EQUIPMENT

COMPLETELY VENTILATES AND AIR CONDITIONS

RESEARCH LABORATORY

A section of blower room showing centrifugal fans.



Induced draft fans serving boilers.

Research and Development Laboratory of Pure Oil Company, designed by Stone & Webster Architects at Crystal Lake, Illinois.

General Blower has developed a rugged line of blowers with minimum impeller noise. They are engineered for quiet operation. All General Blowers have been time-tested, and operate efficiently under the most severe conditions. Installed herein for conventional ventilating requirements and also for exhausting fumes and gases from chemist's hoods and laboratories, also large fans for heating and air conditioning.

Induced draft fans were installed on boilers (in this particular case eliminating the necessity of a smoke stack or chimney.)

LUNGS FOR INDUSTRY

General Blower ventilating fans are manufactured for industrial and commercial ventilating and heating, fume extraction, induced draft, forced draft, air conditioning, drying and processing. They are of forward or backward curved wheel design. Type F.C. are designed for quiet operation at low speeds. Type B.B. are designed to operate at high speeds and have the non-overloading characteristics. Capacities of 200 c.f.m. to 300,000 c.f.m. are covered by standard sizes and arrangements.

For full particulars write for

"Lungs for Industry"

GENERAL BLOWER COMPANY

8622 Ferris Street

Norton Grove, Illinois

LADISH *Controlled Quality* ASSURES METALLURGICAL SOUNDNESS

SPECTROGRAPHIC ANALYSIS
One of many comprehensive Ladish laboratory test procedures for assuring reliable performance.

TO MARK PROGRESS

Ladish measures the spectrum to verify chemical composition

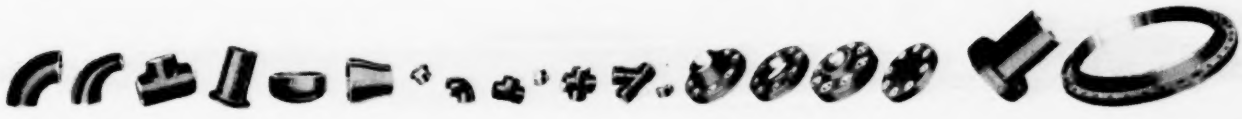
Metallurgical integrity—is safeguarded at Ladish by unsurpassed laboratory controls. Typical is this advanced electronic direct-reading spectrograph. On this unit as many as 300 determinations have been made in one hour to verify compliance of each mill heat with exacting Ladish specifications and, equally important, to assure the absence of detrimental "tramp" elements. Here is but one indication of the thorough, scientific procedures that assure reliability in every Ladish Controlled Quality fitting.

THE COMPLETE *Controlled Quality* FITTINGS LINE
PRODUCED UNDER ONE ROOF . . . ONE RESPONSIBILITY

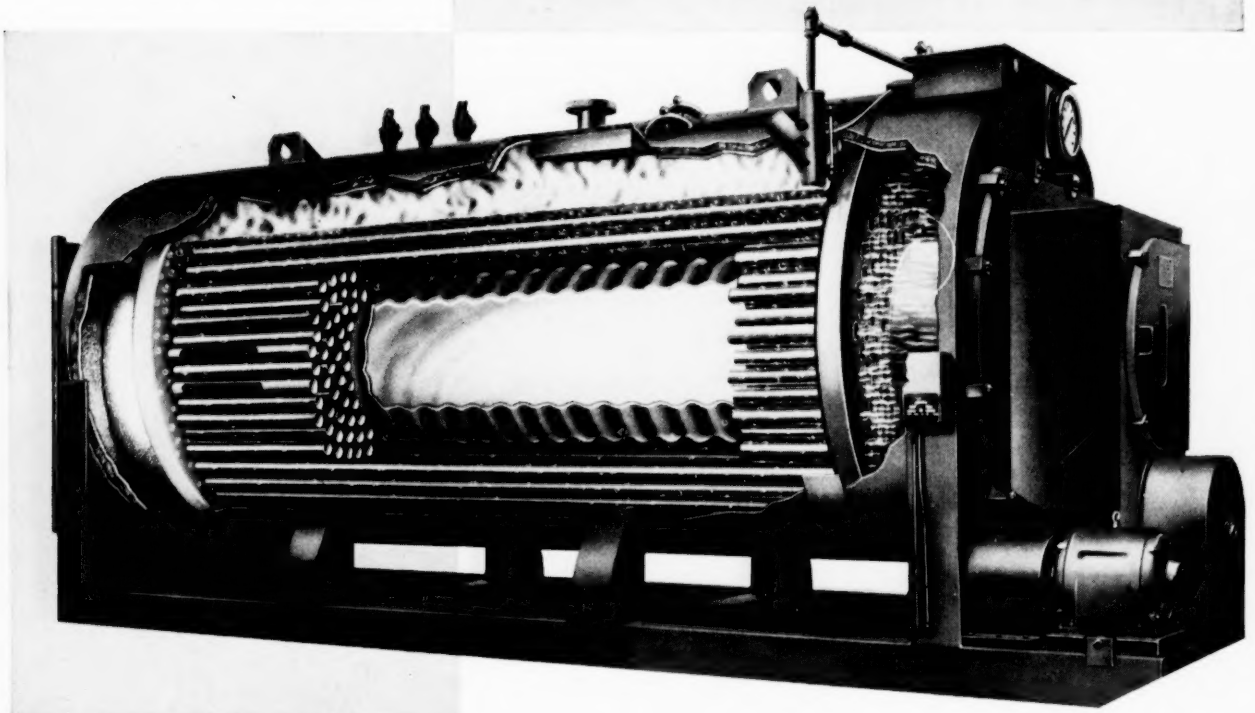
LADISH CO.

CUDAHY, WISCONSIN
MILWAUKEE SUBURB

District Offices: New York • Buffalo • Pittsburgh • Philadelphia • Cleveland • Chicago • St. Paul
St. Louis • Atlanta • Houston • Tulsa • Los Angeles • San Francisco • Havana • Mexico City • Brantford, Ont.



Do You Know About *Continental's* Two Pass Design?



...and do you know it takes one man less than 30 MINUTES to open a CONTINENTAL BOILER for cleaning or inspection...

WITH THE CONTINENTAL, you get a self-contained, automatic steam generator, built of best quality steel, and featuring advanced two pass design. The two pass design eliminates baffles that may break during operation and cause gases to short circuit and destroy efficiency.

WITH THE CONTINENTAL, 80% efficiency is guaranteed. Also, the use of forced draft and the elimination of baffles results in uniform distribution of heat through all tubes . . . insuring long life because all tubes do equal work.

WITH THE CONTINENTAL, you'll hold boiler down-time to a minimum because the clean-out and inspection doors at both ends are hinged and can be easily opened by one man in less than ½ hour.

WITH THE CONTINENTAL, fuel is fired directly into the firing tube which is completely surrounded by water. There is no dutch-oven and there is *no* refractory-lining in the water-backed furnace. This gives you maximum heat transfer, complete combustion, a high CO_2 and a low stack temperature. By eliminating refractory in the furnace, heat is transmitted to the boiler water without being stored and wasted in heating a refractory firebox . . . Steam with less than ½ of 1% moisture is assured in high pressure boilers, and less than 1% moisture in low pressure boilers.

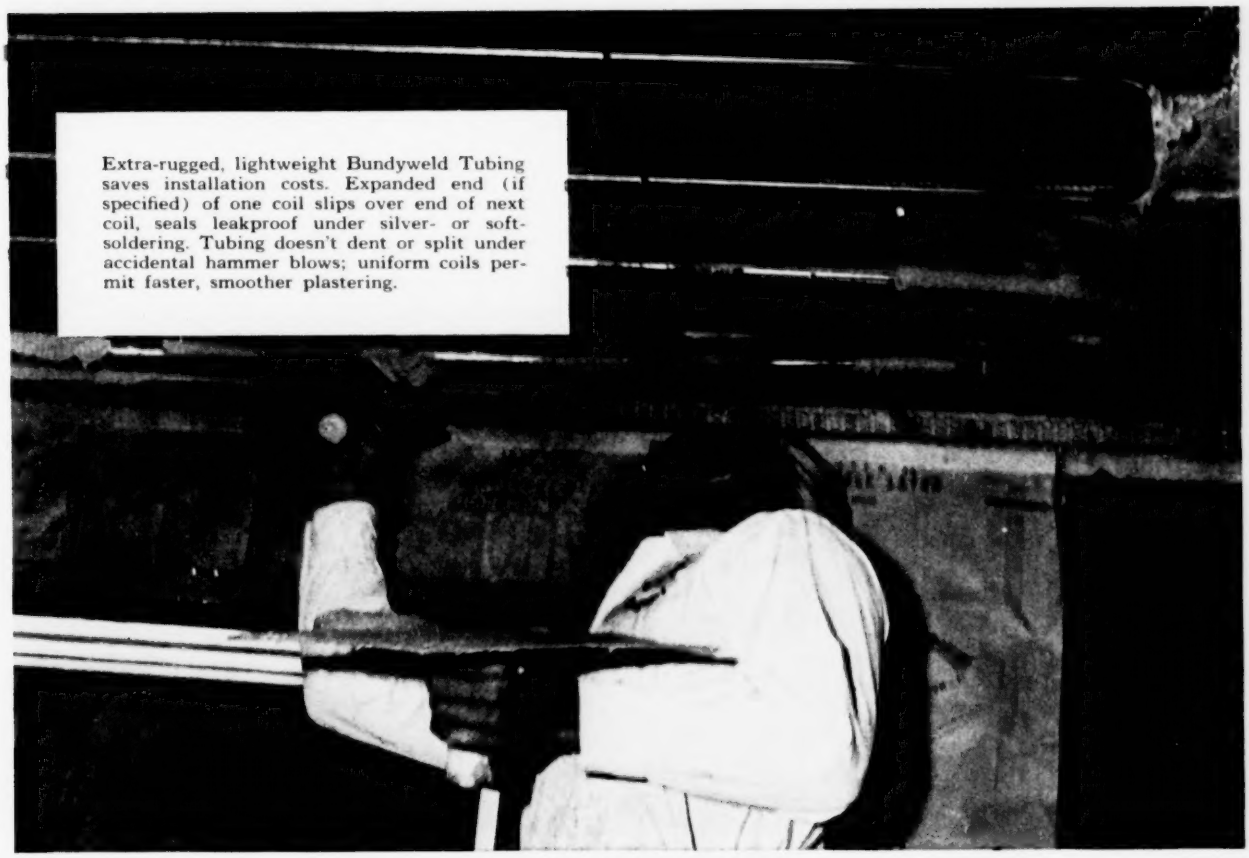
WITH THE CONTINENTAL, you save on fuel (U. S. and foreign patents pending on exclusive firing method). The *oil burner* uses a pressure atomizing nozzle which is easy to service—has no cups or moving parts to wear out. The *gas burner*—rather than premixing—mixes fuel and air at the point of ignition, producing a uniform, highly radiant flame.

WITH THE CONTINENTAL, you get a boiler which, before shipment, is test fired and adjusted for maximum performance. No special stack or foundation required.

Continental Boilers, for high or low pressure, oil or gas fired—or combination thereof, range from 20 to 500 hp. Write for catalog 102.

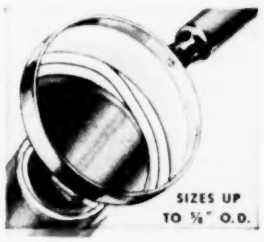
CONTINENTAL is sold, installed and serviced by competent distributors throughout the U.S.

BOILER ENGINEERING
AND SUPPLY COMPANY, INC.
1 Manavon Street • Phoenixville, Pa.
40 Years of Boiler Experience



Extra-rugged, lightweight Bundyweld Tubing saves installation costs. Expanded end (if specified) of one coil slips over end of next coil, seals leakproof under silver- or soft-soldering. Tubing doesn't dent or split under accidental hammer blows; uniform coils permit faster, smoother plastering.

It's *easy* to make competitors "also-rans" through Bundyweld Ceiling Radiant Heating



Key to Low Cost

Bundyweld is the only tubing double-walled from a single strip, copper-brazed through 360° of wall contact. It's leakproof, thinner walled, yet stronger. It transmits heat quickly, has high bursting strength. It saves on material costs and installation time.

Standard 20' lengths of Bundyweld are easily formed into coils in shop or on job site. Expanded ends (furnished when specified) are quickly silver- or soft-soldered into leakproof union. Joined, lightweight coils are easily mounted onto ceiling, quickly plastered over.

There's an easy way to make "also-rans" of your local competitors, to make their prospects *your customers.*

How? By meeting customer demand for the heating system that makes all others obsolete; by offering Bundyweld Ceiling Radiant Heating.

By *user* testimony, this revolutionary *new* system brings gratifying freedom from drafts, dust, soot; eliminates space-stealing radiators or registers; is even-temperatured and economical, postponing redecorating *years.* These proved advantages have impressed themselves on thousands of near-ready home buyers and builders through Bundy ads in *Better Homes & Gardens, American Home, Small Homes Guide,* and *House Beautiful.*

Contractors find rigid, lightweight, leakproof Bundyweld far easier, quicker to bend and position than any other tubing. Silver- or soft-soldering gives a leakproof union; uniform coils speed plastering.

Sales are aided by our replies to requests for literature, *names* of plumbing and heating contractors handling Bundyweld Ceiling Radiant Heating. Simple to install, it makes sales. Mail coupon *now* for the full story.

Radiant Heating Division
BUNDY TUBING COMPANY
Detroit 14, Michigan

SEND FOR FREE LITERATURE!

Bundyweld
Ceiling Radiant Heating

Radiant Heating Division, Dept. HV-953
Bundy Tubing Company, Detroit 14, Mich.

☐ Send free 20-page nontechnical brochure explaining Bundyweld Ceiling Radiant Heating.
☐ Send Bundy technical radiant heating pamphlet.

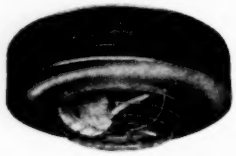
Name _____ Title _____
Company _____
Address _____
City _____ Zone ____ State _____

Mark...Get the leader!
Mark Minnesota!
Glorious land of 10,000 sparkling lakes!
Famed fly-way for Southbound Blue
and Canadian geese! Here, too, at
America's headquarters for the changing
seasons, is the home of McQuay,
specialists in Heat Transfer Equipment.

BLOWER TYPE HEATING AND VENTILATING UNITS

For effective heat distribution over large open areas. Available in 8 sizes . . . in suspended and floor models, with one and two row coils; capacities from 20,620 to 1,632,000 Btu per hour.

DOWN FLOW UNIT HEATERS



This McQuay "vertical" unit heater, suspended near the ceiling, utilizes the warm air in that area and distributes it down to the floor level. No wasted heat, no cold spots. Four types of draftless diffusers available. Capacities from 25,400 to 500,000 Btu per hour.

When approaching cold weather gives your customers the urge to fly south with the "honkers", tell them to buy instead the comfort and satisfaction that McQuay Horizontal Unit Heaters can give them.

McQuay Horizontal Unit Heaters are made in a wide range of capacities, from 21,600 to 360,000 Btu per hour. Every unit has the exclusive Ripple Fin Coil construction . . . with these advantages: more heat transfer surface, greater flexible strength, cleaner operation . . . flexible copper tube headers to accommodate unequal expansion and contraction. Tubes expanded into fins having wide, smooth collars, without use of any low conductivity bonding agents, provide a permanent mechanical bond.

These advantages, plus modern cabinet styling, quiet motor fan assembly and Test Code Ratings are your guarantee of satisfied customers—especially if you convince them the time to get the job done is now—before, not after, the heat is needed. Write for catalog. Representatives in principal cities. McQuay Inc., 1619 Broadway St. N.E., Minneapolis 13, Minnesota.

McQuay INC.

AIR CONDITIONING • HEATING REFRIGERATION

HEATING PUMPS

To always meet

ALL REQUIREMENTS

CHICAGO INDUSTRIAL PUMPS

Chicago's complete line of heating pumps are designed to meet the specific and exacting needs of building service. When you specify Chicago Heating Pumps you can be certain you will always get the correct pump for the job.

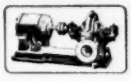
You can get the complete data on any or all series of Chicago Heating Pumps simply by writing for the technical Bulletin referred to under each type. This information is truly complete—includes engineering, specification and dimension data, as well as performance records, charts and tables.

CHICAGO PUMP COMPANY

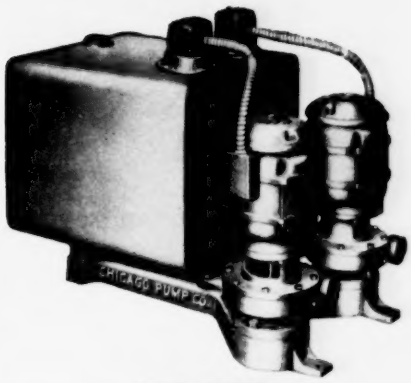
BUILDING and INDUSTRIAL DIVISION

622 DIVERSEY PARKWAY **CHICAGO 14, ILLINOIS**

Condo-Vac, Sure Return, AVC, LVC, Fire, House & Circulating Pumps Pneumatic & Tankless Water Systems



Flush-Kleen Sewage Ejectors Little Giant & Non-Clog Bilge Pumps Pumps for every industrial use

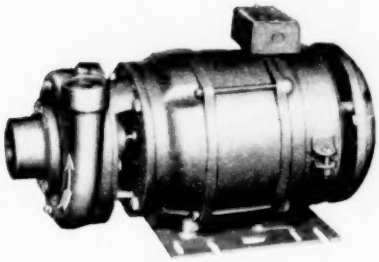


SURE RETURN CONDENSATION PUMP & RECEIVER

For systems up to 75,000 EDR and for low and medium pressures. Available in either single or duplex units. The base serves as a large capacity manifold through which the condensate flows by gravity from the receiver to the pump. The Sure Return will not steam bind. Described in Bulletin 250.

TYPE CLLI VERTICAL CONDENSATION PUMP & RECEIVER

Specifically designed for low return service and underground installations. Flanges are accurately finished and gasketed to prevent steam leaks. Pump and receiver are shipped as a unit, ready to install. For 1000 to 40,000 EDR and 10 to 25 lbs. pressure. Described in Bulletin 255.

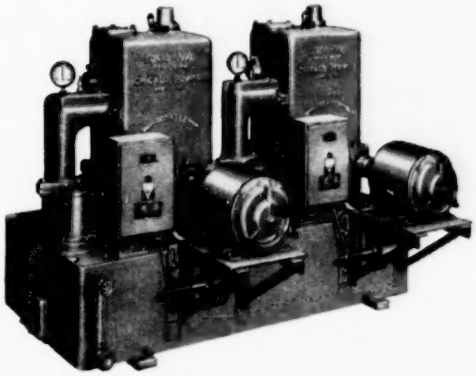


C-C CLOSE-COUPLED SERIES PUMPS

C-C Series Pumps combine pump and motor in a single compact unit for easy installation, eliminating coupling and alignment problems, and are equipped with the leak-proof CHICAGO mechanical seal. Each pump operates over the entire range of its curve without motor over-load.

DUPLEX CONDO-VAC RETURN LINE VACUUM AND BOILER FEED PUMP

Specifically designed for vacuum heating systems. The water capacity of the Condo-Vac remains constant up to the boiling point. The air capacity remains constant to the evaporation point. Pressures up to 40 lbs. Capacities from 2500 to 150,000 EDR. Described in Bulletin 270.



TYPE AVC CONDENSATION PUMP & RECEIVER

Heavy cast iron receiver with low inlet for floor mounting or shallow pit. Sets on floor—no foundation bolts necessary. Weight of unit and piping hold unit firmly in place. For 500 to 10,000 EDR and 10 to 30 lbs. pressure. See Bulletin 245.

These Bright Spangles Attract Customers

The thousands of gleaming zinc spangles on a Bethlehem galvanized steel sheet are a powerful sales feature. The light they reflect gives this sheet a bright, clean appearance that attracts the eye.

But good appearance is only part of the story. This coating is not only attractive—it is tight, uniform, and ductile. It provides excellent protection against corrosion. And it holds securely, even after the sheet is formed or bent.

Bethlehem galvanized sheets are made from strong, durable steel, either plain or copper-bearing. They are easy to work with, and they go a long way toward helping you turn out neat, professional-looking jobs.

Bethlehem GALVANIZED Steel Sheets

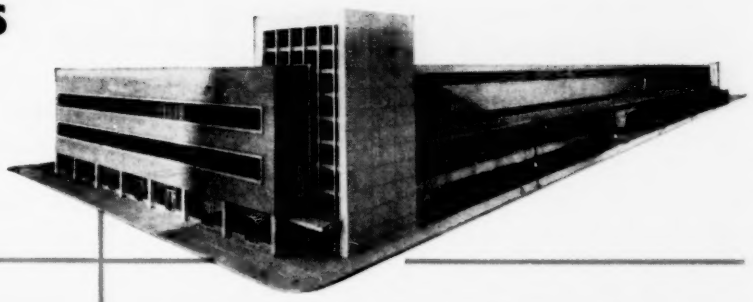
★ BETHLEHEM STEEL ★

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

Export Distributor: Bethlehem Steel Export Corporation

MAXIMUM STEAM SAVINGS with JOHNSON CONTROL in all types of buildings



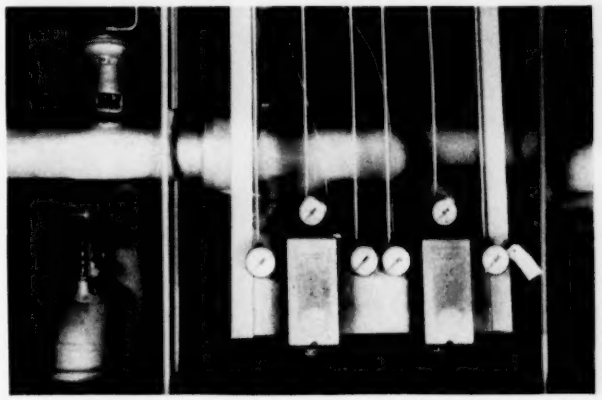
Pennsylvania Duquesne Warehouse, Pittsburgh, operated by Pitt-Penn Terminal Company. Hunting, Larsen & Dunnells, architects; T. F. Rockwell, mechanical engineer; Sauer, Inc., mechanical contractors, all of Pittsburgh.

To provide the best in warehouse and shipper service, the Pennsylvania Railroad constructed this four-block-long warehouse and terminal building, which is operated under lease by the Pitt-Penn Terminal Company.

This interesting building is another example of the adaptability of Johnson Automatic Temperature Control. The offices are heated by radiant panels which are under the control of a Johnson Master-Submaster System, regulating the steam supply to hot water converters. This weather-compensated system supplies the floor panels with hot water at just the right temperature, as dictated by the outdoor temperature. Convectors throughout the building are under the control of a similar weather-compensated system. Offices and store rooms along Twelfth Street have individual room control, with provision for future cooling.

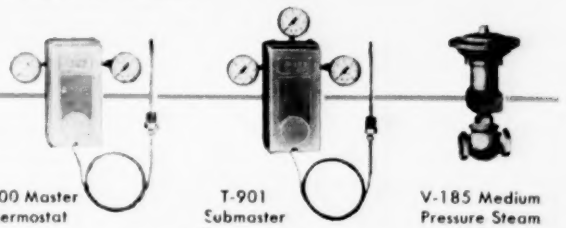
All apparatus is combined into a planned-for-the-purpose, installed-for-the-purpose automatic temperature control system, resulting in maximum steam savings.

Ask a Johnson engineer from a nearby branch office for recommendations on any automatic control problem—large or small, in both new and existing buildings. There is no obligation. JOHNSON SERVICE COMPANY, Milwaukee 2, Wisconsin. Direct Branch Offices in Principal Cities.



Johnson Valves, operated by Johnson Submaster Thermostats, control the steam supply for hot water converters.

In office sections, hot water temperatures in radiant floor panels are varied automatically to compensate for outdoor temperature changes.



T-900 Master Thermostat

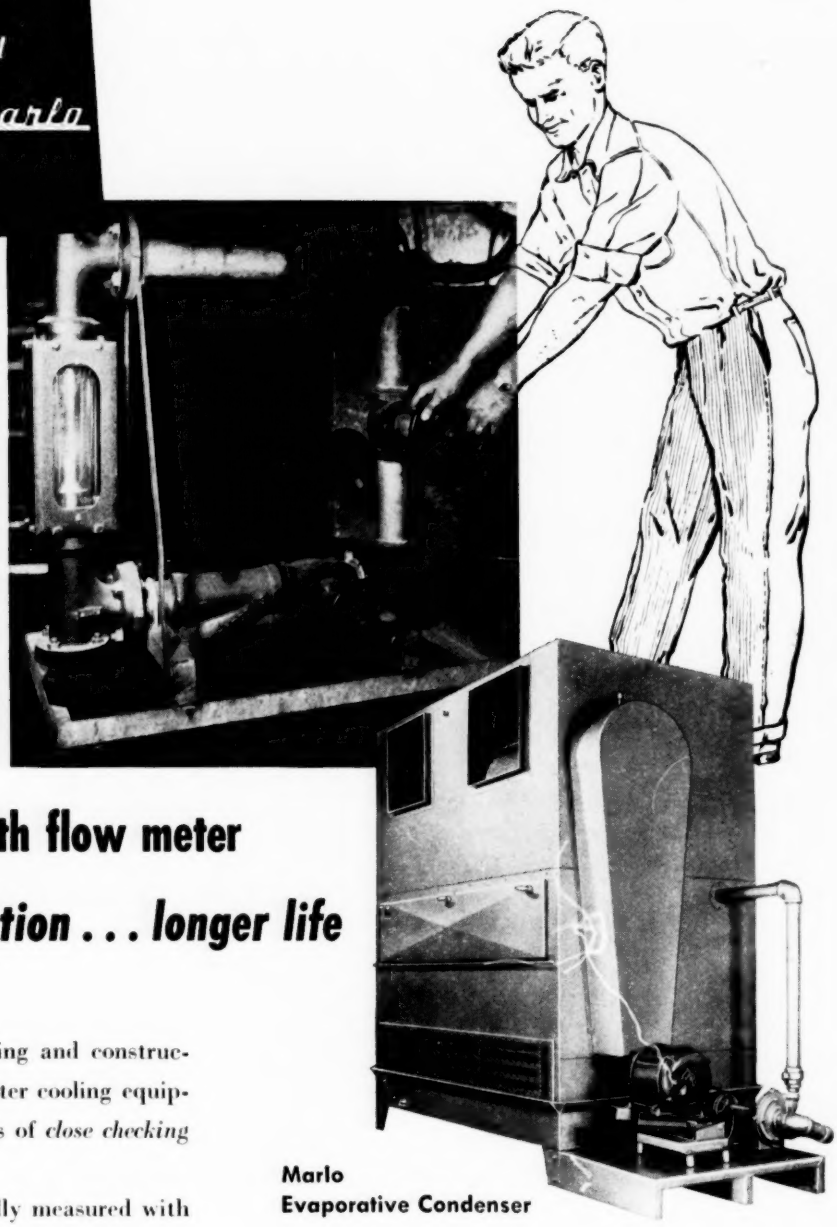
T-901 Submaster Thermostat

V-185 Medium Pressure Steam Valve

JOHNSON *Automatic Temperature and Air Conditioning* **CONTROL**

MANUFACTURE • APPLICATION • INSTALLATION • SINCE 1885

You get MORE than just equipment when you specify Marlo Air Conditioning



for example . . .

Marlo

checks pumps with flow meter to insure *better operation . . . longer life*

To the superior engineering and construction of the pumps on Marlo water cooling equipment are added the plus values of *close checking and testing* before delivery.

The rate of flow is carefully measured with a flow meter to assure that the pump is performing most efficiently for the capacity requirements.

Shaft rotates on double-roll sealed ball bearings. Impellers are bronze, dynamically balanced to reduce vibration to a minimum.

Marlo Evaporative Condenser

Such scrupulous attention to little details of construction and operation is a principal reason why MARLO QUALITY PAYS IN THE LONG RUN.

Marlo COIL COMPANY

Manufacturers of COOLING TOWERS • EVAPORATIVE CONDENSERS • INDUSTRIAL COOLERS • AIR CONDITIONING UNITS • MULTI-ZONE UNITS • BLAST HEATING & COOLING COILS

Saint Louis 10, Missouri

IT FLOATS ON THE LOAD! *

You turn on the steam.

This little stainless steel valve—the only moving part in the Yarway Impulse Steam Trap installed on the equipment—opens wide and *stays* open as the air and condensate continuously pour through.

The equipment reaches production temperature in the quickest possible time.

Production temperature reached, the little valve snaps shut. After that, by a pulsating action, it discharges all condensate as it forms—even a tiny teaspoonful. *There's hot steam in the equipment all the time . . .* steady, maximum temperatures are maintained.

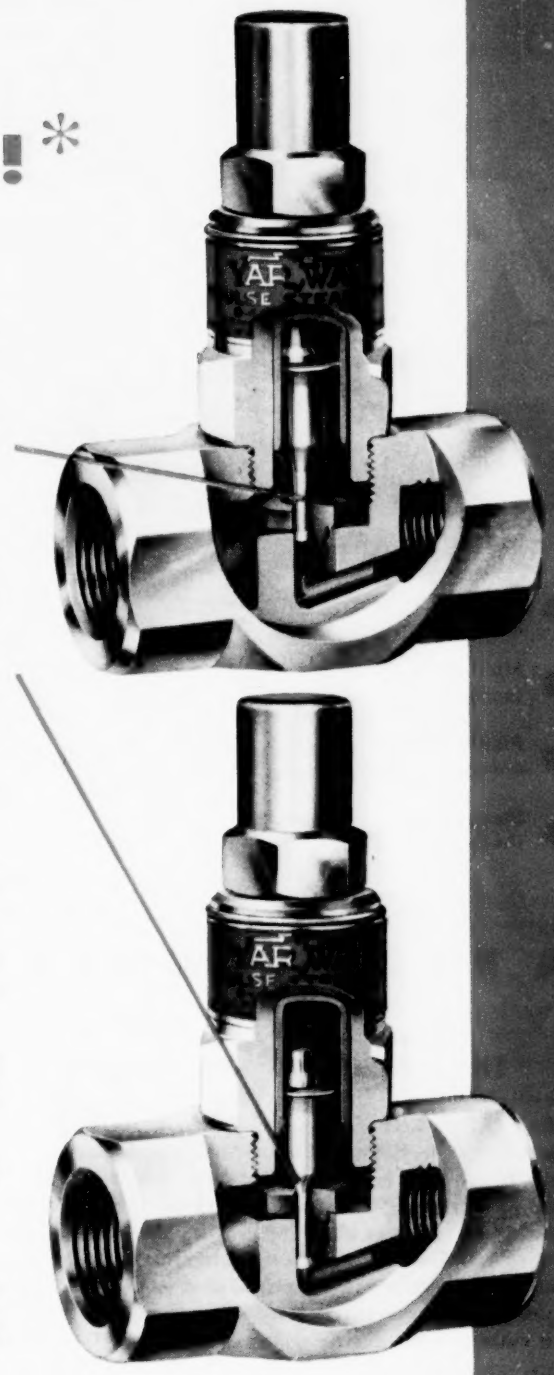
It all adds up—to more production per day.

Other profit-making features of the Yarway Impulse Steam Trap—low initial cost, easy installation, stainless steel construction, low maintenance, good for all pressures, quick delivery from over 200 local industrial distributors.

Try a Yarway—free for 60 days—and *prove* its advantage. Your distributor will supply you.

For free Yarway Impulse Steam Trap Bulletin T-1740, write . . .

YARNALL-WARING COMPANY
104 Mermaid Ave., Philadelphia 18, Pa.



* *. . . resulting in fast heat-up of equipment, more production per day.*

YARWAY | ***impulse steam trap***

it's NEW!

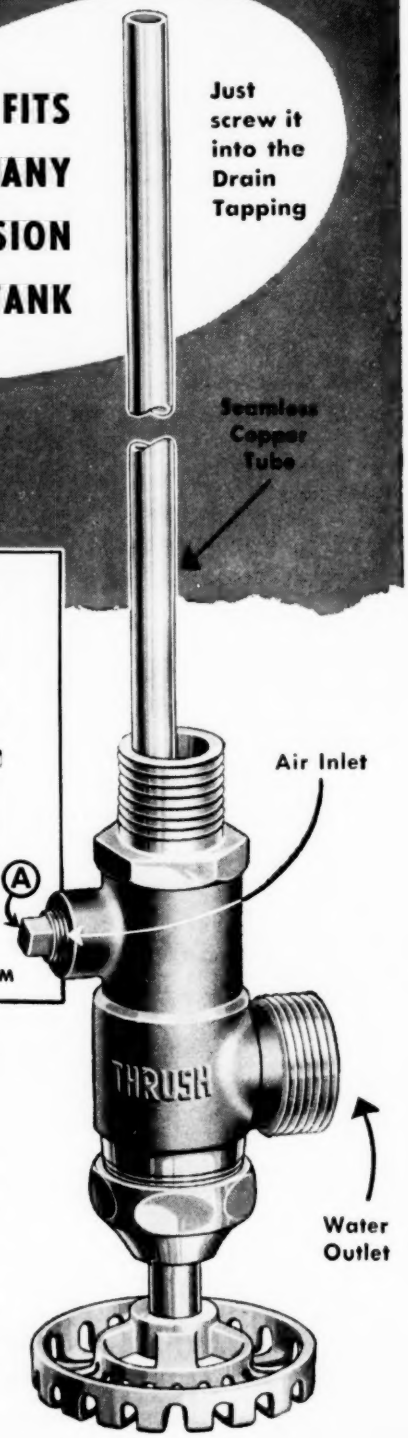
THRUSH Tank Drain

Reduces DRAINING TIME

FITS ANY EXPANSION TANK

Just screw it into the Drain Tapping

Seamless Copper Tube



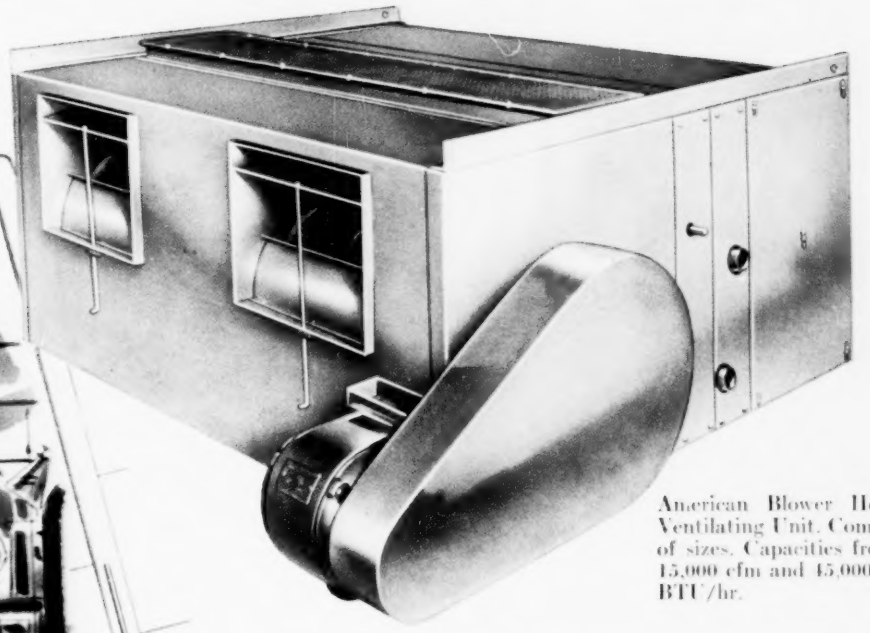
- A simple, inexpensive valve combining air tube and drain.
- Fits drain tapping . . . easily installed . . . inexpensive. Two tube lengths.
- Eliminates guesswork, saves time. A few minutes drains the average size tank.
- Pleases home owner, pays for itself on the first draining.

A REAL CONVENIENCE
and profit maker too!

DRAINING waterlogged pressure tanks is simple, quick and positive if you'll install a Thrush Tank Drain. While all genuine Thrush Pressure Tanks now come equipped with the Thrush Vacuum Breaker, there are many older installations where the tank has only one drain tapping. Now you can enjoy the same convenience in tank draining on these older jobs, too. The Thrush Tank Drain combines Vacuum Breaker and Drain Valve in one inexpensive fitting. When the tank needs draining, simply open drain, remove plug "A" to break the vacuum and tank will drain completely. It is a profit item you can sell all year through. For more information, see your wholesaler or write Department D-9.

THRUSH [illegible] Parts, Indiana

American Blower – a time-honored name in air handling



American Blower Heating and Ventilating Unit. Complete range of sizes. Capacities from 1000 to 15,000 cfm and 45,000 to 976,000 BTU/hr.

That delightfully fresh, pleasant atmosphere which works wonders for employee morale, working and selling conditions, is assured when American Blower Heating and Ventilating Units are installed.

These dependable units, with slow-speed centrifugal fans, are available in a wide range of sizes for wall, horizontal, inverted and floor installation. Each fan housing is equipped with Aileron control. Humidifiers, face and by-pass dampers, filter boxes and mixing boxes are available.

Investigate these efficient Heating and Ventilating Units *now*. Call your nearest American Blower Branch Office for data.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary Corporation

AMERICAN BLOWER

YOUR BEST BUY IN AIR HANDLING EQUIPMENT

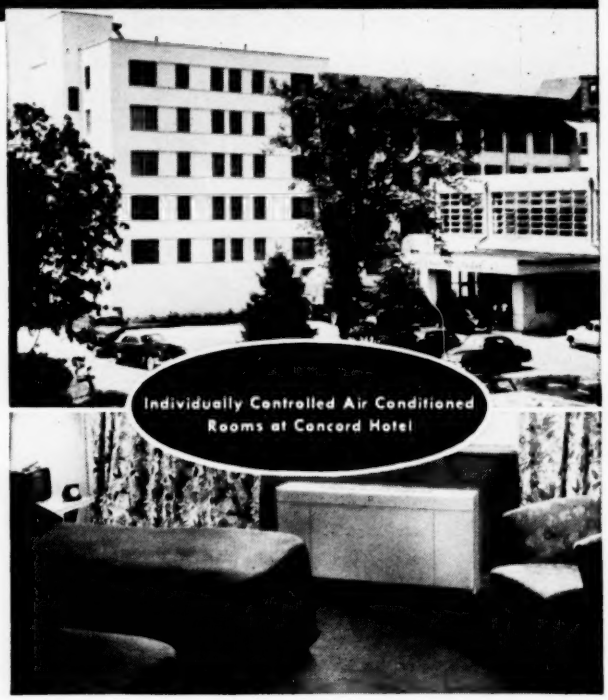
Serving home and industry

AMERICAN-STANDARD · AMERICAN BLOWER · CHURCH SEATS & WALL TILE · DETROIT CONTROLS · KEWANEE BOILERS · ROSS EXCHANGERS

Another interesting REMOTAIRE installation!

Individual-room remote type units in resort hotel provide year 'round air conditioning

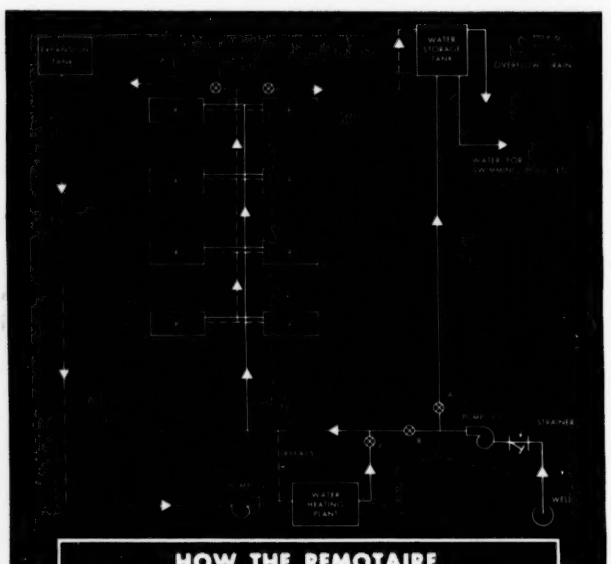
Summer cooling... winter heating



● The Concord Hotel, Kiamesha Lake, New York, found the answer to efficient, economical year 'round air conditioning through the installation of the Remotaire Well Water System—one of a number of different Remotaire systems available for multi-room buildings.

The Remotaire Well Water System may be used in localities where well water is known to be available in adequate supply, proper temperature, and of good quality. The cold well water is used in lieu of a water chilling plant. Consisting of Remotaire Room Units in each room connected by a piping system to the central plant equipment (as shown in the diagram), this system costs less to install and less to operate. Individual control of each Remotaire unit allows the occupant to choose the room temperature that suits him best without affecting adjoining rooms.

This resort hotel installation is another example of the versatility of the Remotaire for hotels, motels, hospitals, apartments, and other multi-room buildings.



HOW THE REMOTAIRE WELL WATER SYSTEM WORKS

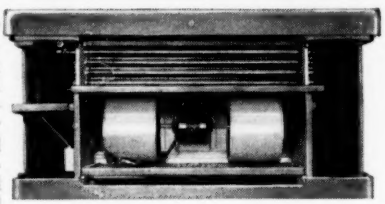
The Remotaire Well Water System consists of Remotaire Room Units in each room connected by a simple piping system to the central plant equipment—a well with pump, water heater, water circulating pump, expansion tank, storage tank and water filter or strainer as shown above.

FOR COOLING—Valves A and C are closed. B is open. Pump No. 1 pumps water from well to Remotaire units on each floor from which it travels thru valve D to storage tank on roof. This water is usable for swimming pool or other purposes.

FOR HEATING—Heating circuit includes Water Heater, Valve C, Valve E, Expansion Tank, Pump No. 2 and bypass. For operation, close Valves B and D, start Pump No. 2 and boiler, and the hot water circulates through the system.

When cooling is not required, well water may be used for other purposes, and can be pumped direct through Valve A to Water Storage Tank by Pump No. 1.

Top Quality Construction... Easy To Install



The Remotaire is sturdily built of heavy-gauge steel—plus a reinforced air grille—with a bonderized, baked-on semi-gloss enamel finish. All air passages are acoustically insulated for thermal efficiency and quietness. Coil is designed for right or left hand connections. Spacious end compartments permit easy access to coil connections and controls. Adaptable to a variety of ventilation systems, the Remotaire is ideal for modernization as well as new construction and is available in three models—200, 400 and 600 cfm.

Write for Remotaire Brochure, Form 298.

American Radiator & Standard Sanitary Corporation
P. O. Box 1226, Pittsburgh 30, Pa.

AMERICAN-Standard
HEATING-COOLING

Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE
DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS

ANOTHER REPORT OF READING COPPER TUBING "ON THE JOB" . . .

NORTH CAROLINA CONTRACTOR HAS

Installed READING COPPER TUBE Exclusively Since 1946!

The huge Mallonee Village project, erected in 1951-1952 at Fort Bragg, N. C., consists of 2,200 permanent military housing units plus an ultra-modern, air-conditioned shopping center. For the forced hot water heating system and the hot and cold water lines of the housing units and the air conditioning system of the shopping center, more than a million feet of Reading Copper Tube were installed by Brownlow's, Inc., of Winston-Salem, N. C.

Brownlow's, Inc. is one of the leading mechanical contracting firms in the southeast. Mallonee Village is one of the largest of the many government contracts they have been awarded. *Since 1946, Brownlow's, Inc. has used Reading Copper Tubing exclusively and has installed more than ten million feet during that time!* Among the reasons for his firm's preference for Reading Copper Tube, Mr. R. L. Brownlow, President of Brownlow's, Inc. lists its uniform high quality, precision manufacture, ease of handling and bending, fewer joints and fast, dependable delivery through local distributors.

In One Installation Alone

MALLONEE VILLAGE, FORT BRAGG, N. C.

Brownlow's, Inc. Installed More Than 1,000,000 Feet of Reading Copper Tube!

R. L. BROWNLOW
President

GEO. W. BROWNLOW, JR.
Vice Pres.

O. C. TUCKER
Sec.-Treas.

ARCHITECT:
Seward, Mott & Associates, Washington, D. C.
GENERAL CONTRACTOR:
Loving Weaver, Fort Bragg, N. C.
MECHANICAL CONTRACTOR:
Brownlow's, Inc. Winston-Salem, N. C.

Sold Exclusively Through Plumbing and Heating Supply Wholesalers!

READING TUBE CORPORATION

Producers of Reading Lektroneal Copper Tubing and Reading 85% Grade A Red Brass Pipe

READING COPPER TUBING

OFFICES AND EASTERN DISTRIBUTION DEPOT:

36-12 47th Ave., Long Island City, N. Y. • STillwell 6-9200 *Works: Reading, Pa.*

DISTRIBUTION DEPOTS: Reading, Pa. • Long Island City, N. Y. • Houston, Texas, 1121 Rothwell St. Chicago, Ill., 724 W. 50th St. • Atlanta, Ga., 690 Murphy Ave. S.W. Unit 5, Bldg. B

5 reasons why you when you handle Trane

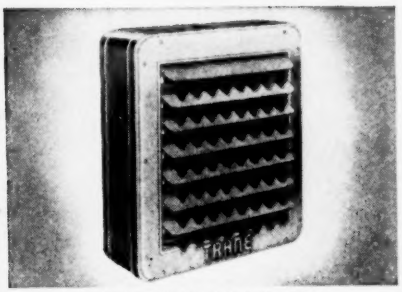
1. SERVICE—Over 250 TRANE sales engineers in 87 U.S. offices are specially trained to assist you . . . are available when you need them. Their equipment recommendations are accurate since they're based on the most complete line of soundly engineered heating products.

2. QUALITY—The popularity of TRANE Unit Heaters has been built over many years as a result of a reputation for quality, dependable service, exclusive features. These time-tested products give you extra freedom in selecting *from one source* the exact units to fit the job.

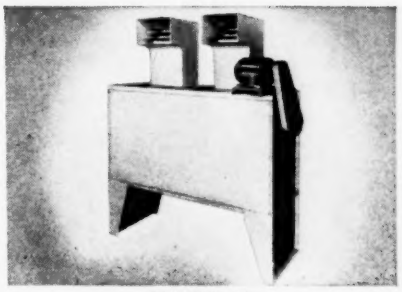
Build better heating into your

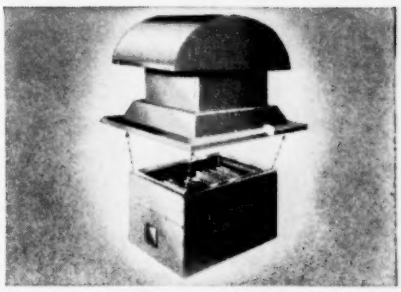
MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING AND VENTILATING EQUIPMENT

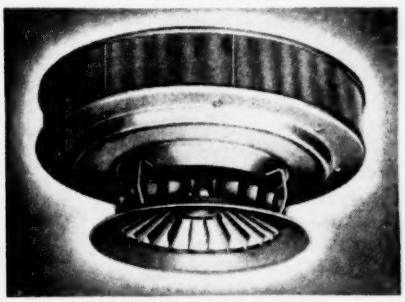
make your job easier
Unit Heaters

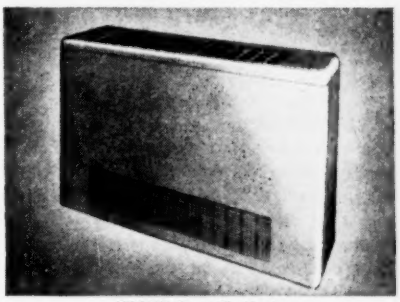


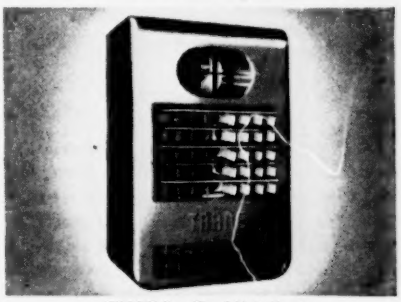
TRANE Model H Unit Heater


TRANE Torridor


TRANE Ventilating Heater


TRANE Model P Projection Heater


TRANE Force-Flo Heater


TRANE Gas-Fired Unit Heater

3. Complete line of engineered blower and propeller-type unit heaters includes these six types in a wide range of sizes and capacities. For steam, hot water or gas; with vertical or horizontal air streams; for free delivery or with duct work; floor, wall or ceiling mounted units.

4. Most complete library of useful information. TRANE bulletins give detailed roughing-in dimensions, piping diagrams, accurate capacity ratings. Contact your TRANE sales office for complete facts or write to TRANE, La Crosse, Wis.

5. Units in jobber stock. Model P, Model H, gas-fired units and matching steam specialties—traps, strainers, valves—are available from many jobbers. Local stock speeds installation, saves delays.

next job with TRANE Unit Heaters

The Trane Company, La Crosse, Wis. • East. Mfg. Div., Scranton, Penn. • Trane Co. of Canada, Ltd., Toronto • 87 U. S. and 14 Canadian Offices

94.9% of Lockheed's 50,000 employees are enrolled in the Payroll Savings Plan

ROBERT E. GROSS

President, Lockheed Aircraft Corporation

National Chairman, 1953 Aircraft
Industry Payroll Savings Drive

"A man's personal economic security is the sum of his own diligent effort, a financially sound government and a systematic savings plan. He has the earnings and he has the government that can protect the individual. However, human nature being what it is, not everyone maintains a systematic plan of savings. So here is a plan designed to help the employee—the Payroll Savings Plan, whereby his company will regularly invest a part of his earnings (he specifies the amount) in United States Savings Bonds, America's safest form of investment. We at Lockheed have endorsed and encouraged this plan because we know what it does to assure security—both individual and national."

Lockheed Aircraft Corporation recently conducted a person-to-person canvass that put a Payroll Savings Application Blank in the hands of every employee of Lockheed's eleven plants in Southern California. At the conclusion of this one-week campaign, 36,419 of the 38,037 employees—95.7%—had signed up on the Payroll Savings Plan. Three of the eleven plants achieved 100% enrollment.

Lockheed's 95.7% in the Southern California plants is the highest employee participation of any company or group of this size this year. The previous national record in the aviation industry—92%—was set by Lockheed's Georgia Division in April, 1953. Of Lockheed's total payroll—50,000 men and women—94.9% are building ". . . security—both individual and national" by systematic investment in U.S. Savings Bonds.

45,000 companies operate Payroll Savings Plans. In many of these companies employee participation ranges from 60% to 80%; in some, it is even higher. On the basis of Payroll Savings Records, it is safe to estimate that 60% or more of the personnel of a company will join the Payroll Savings Plan—

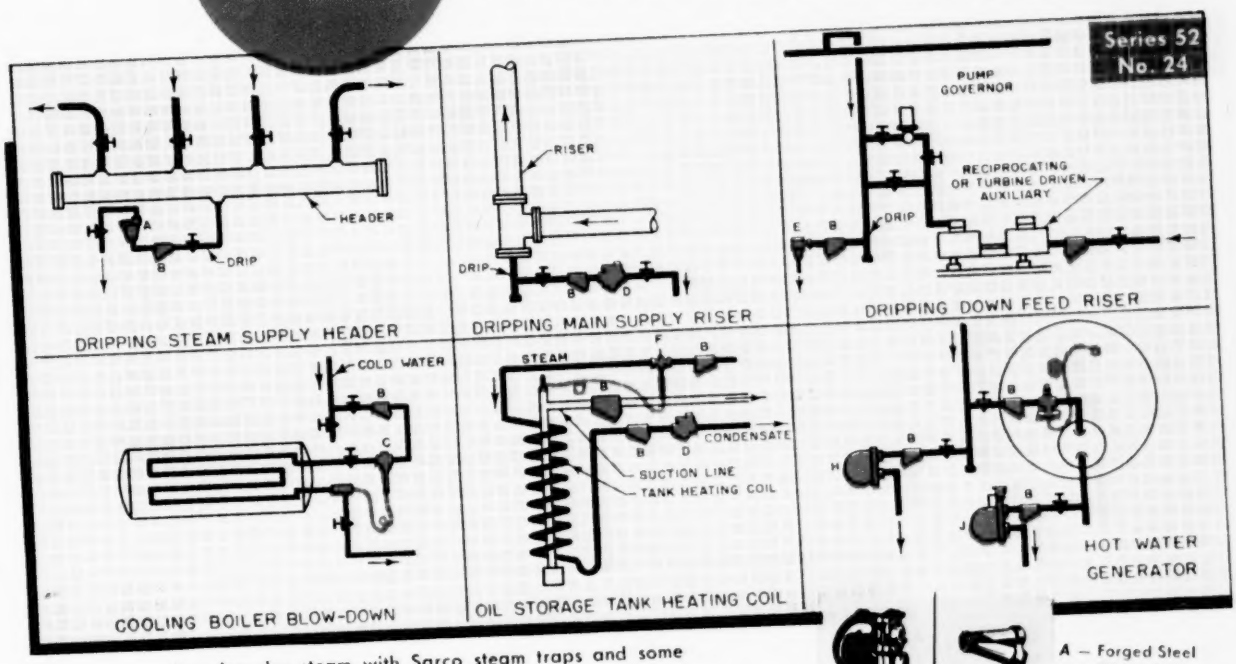
—if the many personal benefits of the Payroll Savings Plan are properly presented to them by management.

—if they are shown how their monthly investment in Savings Bonds contributes to national stability by adding to our reservoir of future purchasing power—$35.5 billion—the cash value of outstanding Series E Bonds—the kind purchased by Payroll Savers.

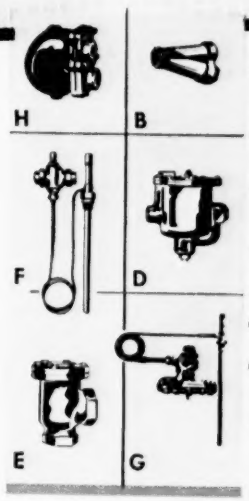
Your State Director, U.S. Treasury Department, is ready to help you build a 60%, 70% or 80% Payroll Savings Plan. He'll explain how easy it is to conduct a simple person-to-person canvass and will furnish all the printed matter, posters, etc. Phone, wire or write today to Savings Bond Division, U.S. Treasury Department, Suite 700, Washington Building, Washington, D.C.

The United States Government does not pay for this advertising. The Treasury Department thanks, for their patriotic donation, the Advertising Council and Heating & Ventilating

SARCO in the boiler house...



Assuring dry steam with Sarco steam traps and some Sarco temperature control hook-ups in the boiler house.



A — Forged Steel Bucket Trap
B — Pipe Line Strainer
C — Temperature Regulator, TR-19
D — Inverted Bucket Steam Trap
E — Thermostatic Steam Trap
F — Temperature Regulator TR-21
G — Temperature Regulator 24-30
H — Float-Thermostatic Trap, type FTS
J — Float-Thermostatic Trap, type FTD-M

STEAM TRAPPING AND TEMPERATURE CONTROL problems begin right where steam is generated. The modern boiler plant with its maze of piping and auxiliary equipment offers striking evidence of the advantages of a complete line from one source of supply.

No one type of steam trap or temperature regulator provides the correct solution to all the varied problems presented.

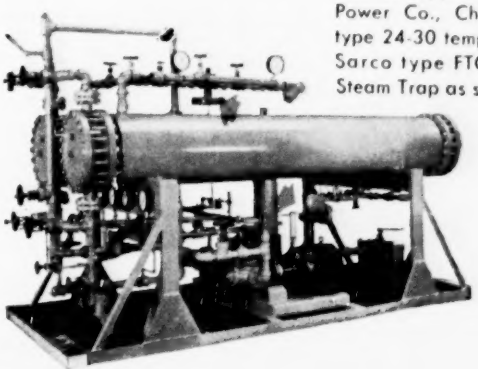
Sarco makes four distinct types of steam traps and can give you unbiased advice on the best type for any job, based on 30 years experience and thousands of installations. ***Write for trap selector chart 145-4.***

The Sarco line of simple temperature control for heating or cooling is complete. ***Full information in Catalog 600-16.***

It pays to standardize on Sarco—exactly the right type of trap or regulator, but all of one make—no divided responsibility!

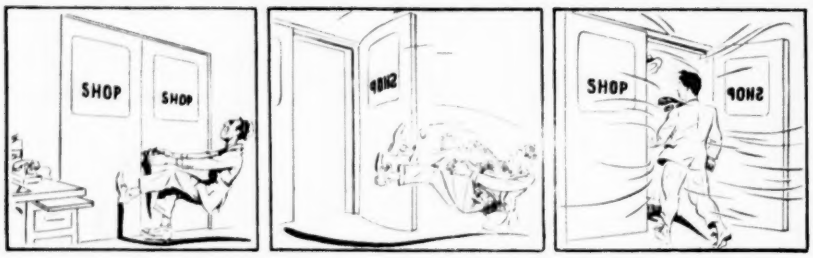
Sarco Company, Inc.
Empire State Bldg., New York 1, N.Y.
Branches in principal cities.
Sarco Canada Ltd., Toronto 8, Ont.

SARCO saves steam
improves product quality and output



Enterprise dual pump set to preheat 3,200 gph of Bunker C fuel oil to 225°F. Supplied by Enterprise Heat & Power Co., Chicago, Ill. with Sarco type 24-30 temperature regulator and Sarco type FTQ Float-Thermostatic Steam Trap as standard equipment.

Is Your Factory Starved for AIR?

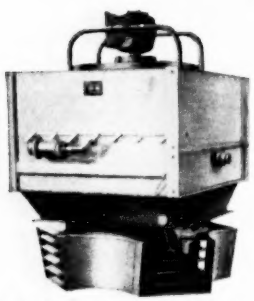


If this is what happens when you go from the office out into the shop, your plant is starved for air! The vacuum created by the operation of necessary exhaust equipment is usually responsible. While our pictures may be slightly overdrawn, something like that may be happening in your plant. Perhaps not so noticeably, for if your building is not new, the vacuum may be relieved by crevices, loose-fitting windows, open doors.

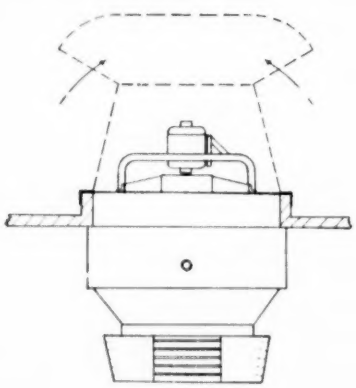
When that happens, your ventilating system, so painstakingly designed and installed to protect your employees and to increase production, can't work properly. And your heating system won't work properly because cold air is being drawn in through every crack and crevice and every opened door.

There is an easy solution. Install WING FRESH AIR SUPPLY HEATERS with Revolving Discharge Outlets. In winter they bring in fresh air through heating coils varied to just the right temperature, replacing exhausted air. In summer, with the steam turned off, they circulate the air in your plant, giving a cool, refreshing sensation to the workers and keeping production up to normal in stifling weather.

WING FRESH AIR SUPPLY HEATERS



WING Fresh Air Supply Unit with fan enclosed in casing.



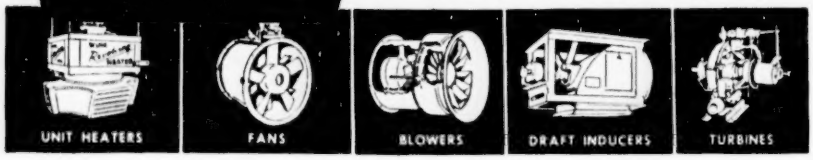
(Right) WING Fresh Air Supply Unit with fan above roof line.

Write for Bulletin HVT-1 and learn the facts about fresh air make-up for your plant.

L. J. Wing Mfg. Co. Linden, N. J.
158 Vreeland Mills Road

Factories: Linden, N.J. & Montreal, Canada
In Europe: Etab. Wanson, Brussels, Belgium

Wing



MOTORIZED CHIMNEY DRAFT

with the WING DRAFT INDUCER

No boiler can operate satisfactorily or efficiently over wide ranges of weather or load with variable natural draft. The fuel—whether oil, gas or coal—must have enough oxygen for complete combustion. There must be sufficient draft or furnace fires will be slow burning and lifeless, resulting in uneven, insufficient and irregular heat.

WING Draft Inducers insure positive, adequate, uniform draft regardless of variable weather conditions or inadequate chimney or breeching construction.

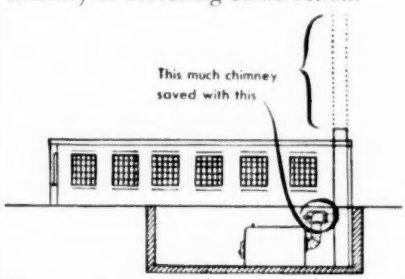


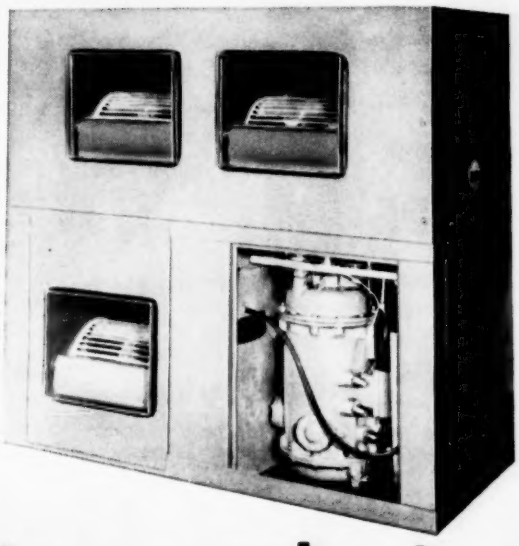
Diagram above shows how much chimney is saved by installing Wing Draft Inducers.

Wing Draft Inducers are suitable for use in connection with oil, gas, stoker-fired or hand-fired heating boilers, industrial furnaces or kilns, or high pressure steam boilers, either stationary or marine. Sizes are available for boilers as low as 1000 sq. ft. E. D. R. up to steam generators producing 100,000 pounds of steam/hr. Special, heavy duty designs available for these larger boilers.

Wing Draft Inducers are made in two types—for insertion in breeching or flue, or for installation on top of a chimney. Write for a copy of Bulletin I-52 to L. J. Wing Mfg. Co., 158 Vreeland Mills Road, Linden, New Jersey.

It's the added Features that...

WATER COOLED
"Packaged" Air
Conditioner



AIR COOLED
"Packaged" Air
Conditioner

make Chrysler Airtemp easier to sell!

Guaranteed by Good Housekeeping

Comfort Zone

PROTECTED BY Bonderite QUALITY CORROSION RESISTANT

When the air conditioners you sell are protected by Bonderite, you have a feature that can be demonstrated quickly and easily to prospects.

Bonderite protects and preserves paint finishes in 3 important ways:

1. Anchors paint to metal
2. Resists corrosion
3. Protects paint around accidental breaks

The Bonderite process at Airtemp consists of 6 separate operations. The equipment alone costs many thousands of dollars. But—it makes a better product—it is a feature you can demonstrate—and you pay no premium for it.

Send for a free sample, so you can prove to yourself that Bonderite makes Chrysler Airtemp easier to sell.

Chrysler Airtemp

HEATING • AIR CONDITIONING
FOR HOME, BUSINESS, INDUSTRY

AIRTEMP DIVISION OF CHRYSLER CORPORATION
DAYTON 1, OHIO

Airtemp Division of Chrysler Corporation H&V-9-53
P.O. Box 1037, Dayton 1, Ohio

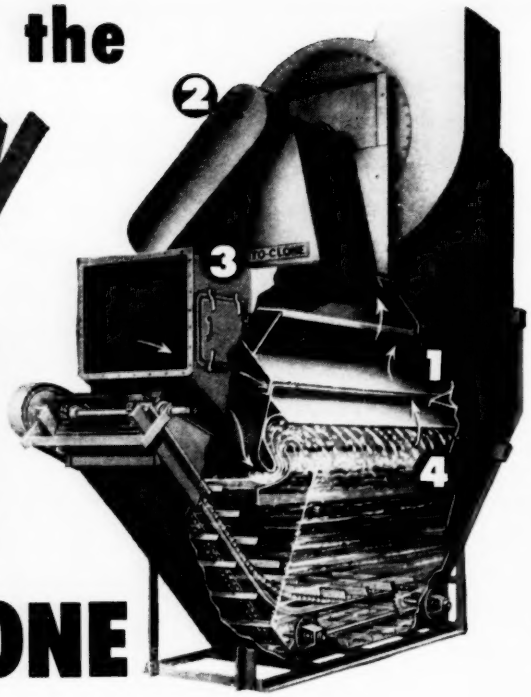
I would like to know more about the Chrysler Airtemp's franchise.

Name _____

Address _____ Phone _____

City _____ Zone _____ State _____

Introducing the NEW DESIGN 4 TYPE N ROTO-CLONE



—1—

Improved and simplified entrainment separators further reduce Type N's low cost maintenance.

—2—

Addition of 4 larger sizes to permit handling of exhaust volumes up to 50,000 cfm.

—3—

Additional access doors with improved hinges.

—4—

Greater range in permissible water over-flow rate from control box.

Famous AAF Hydro-static Dust Collector Loaded with New Features That Reduce Maintenance, Add Life and Lower Cost

The high dust collecting efficiency of the Type N ROTO-CLONE is written on the records of thousands of plants in scores of industries. Magnesium dust, buffing dust, lead oxide, lime and abrasive dust—all posed collection problems until the addition of this product to the ROTO-CLONE line.

The new Design 4 Type N, while retaining the proven cleaning action of its inverted S-shape water curtain, now adds features to further reduce and simplify maintenance, increase service life and *lower cost*.

Check the features listed here. No Gadgets—just sound engineering improvements that save you money both on first cost and every day of operation. For complete information on the new Design 4 Type N ROTO-CLONE write for Bulletin No. 277B.

Plus ADDED FEATURES FOR EACH TYPE N ARRANGEMENT

Arrangement B (Manual Sludge Removal)

1 Sloping sides for easier, faster manual clean-out.

2 Lower section designed for ready conversion from manual to automatic sludge removal.

Arrangement C (Continuous Sludge Disposal)

Heavier sludge ejector chain with longer chain pitch and slower speed—designed for longer life of all sludge ejector parts.

Arrangement D (Continuous Sluicing)

1 New drain control equipped with regulating orifice; built-in flushing connection and lubricated plug valve.

2 New water-supply control, complete with pressure regulator, which automatically assures constant water supply.

You Can Expect the Best from

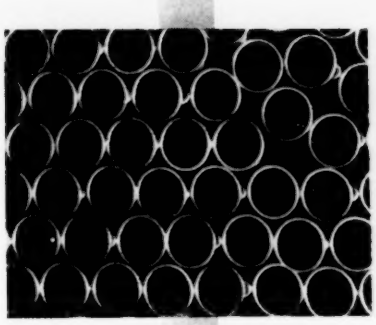
AAF

American Air Filter

COMPANY, INC.

294 Central Avenue, Louisville 8, Kentucky • American Air Filter of Canada, Ltd., Montreal, P. Q.

What Proves the Worth of a Boiler Tube?



Claims of dependability . . . of consistently uniform wall thickness, diameter, and physical properties . . . of freedom from scale, slivers, pitting, and other defects inside and outside a tube, are common—*and true*—for all quality boiler tubes regardless of the mill that supplies them. They are true because *all boiler tubes must conform to the same specifications for the same jobs.* Side-by-side they're "look-alikes," yet there is a difference . . . a difference that only *time* can prove under the grueling conditions of heat, pressure, corrosion, and oxidation found inside a modern boiler. B&W boiler tubes have met this test of time in boilers serving the widest variety of applications . . . utilities, industries, government institutions, hospitals, office buildings, apartment houses . . . wherever fine boilers are operating efficiently over extended periods.

Say B&W before you say WELDED BOILER TUBES—for Service-Proved Dependability.
For three-quarters of a century, B&W has been directly concerned with developing and applying boiler tubes for lowest pressures up to those approaching 3000 psi. The application of this extensive knowledge and experience results naturally in the production of finer boiler tubes.

B&W dependability is proved by time and endorsed by hundreds of customers who keep coming back for more . . .

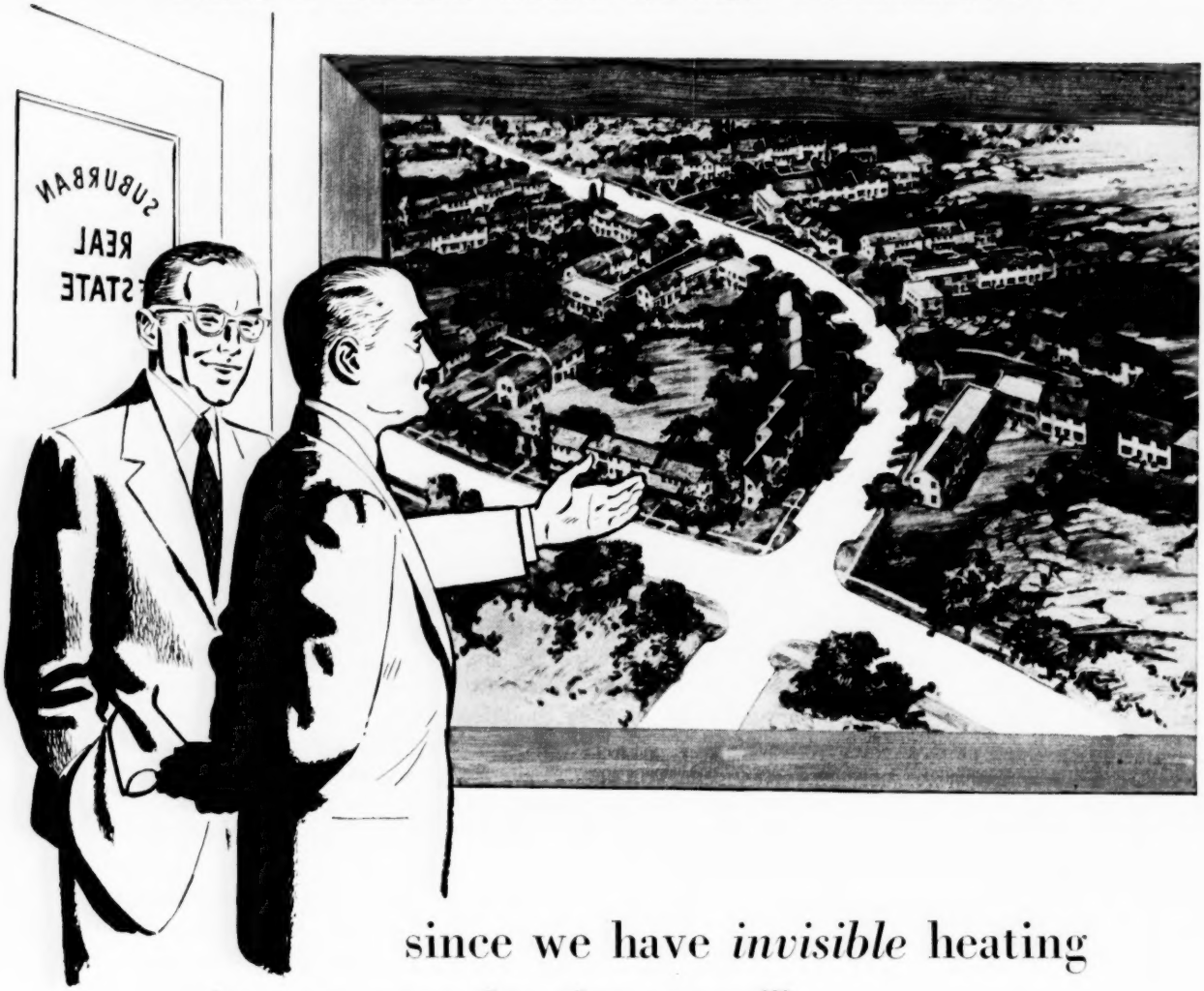
B&W WELDED BOILER TUBES.

B&W SEAMLESS and WELDED TUBES

THE BABCOCK & WILCOX COMPANY
TUBULAR PRODUCTS DIVISION
Beaver Falls, Pa.—Seamless Tubing; Welded Stainless Steel Tubing
Alliance, Ohio—Welded Carbon Steel Tubing

TA-1742 (A)

"The Future sure looks *radiant* . . .



since we have *invisible* heating in our new development!"

Yes, real estate men, along with architects, engineers and plumbing and heating contractors, know that *radiant heated* properties are easier to rent and sell, command a maximum figure, reduce tenant and owner turnover, and minimize maintenance, cleaning and decorating costs.

Looking at it from *either* the owners' or tenants' side, it's easy to understand. Uniformly comfortable heat with no hot or cold spots, warm, draft-free floors to protect the health of the family, cleaner air, complete freedom of decoration from unobstructed wall and floor space . . . all add up to good reasons for mutual satisfaction.

Investment-wise, too, *steel pipe* encourages the use of popular radiant panel heating, in one or hundreds of dwellings. For in this single heat transmission medium is blended the advantages of economy, formability, weldability, and durability . . . all backed up by more than 60 years of *proved* performance in conventional hot water and steam heating applications.

That's why, for radiant panel heating, snow melting and other applications *steel* is the most widely used *pipe* in the world!

★ ★ ★

A free 48 page color booklet, "Radiant Panel Heating with Steel Pipe", is still available. A new, free companion booklet, "Snow Melting and Ice Removal Systems" is also ready! Ask for one or both, without obligation.

Steel Pipe is First Choice

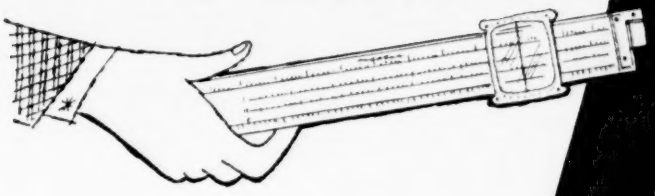
COMMITTEE ON STEEL PIPE RESEARCH

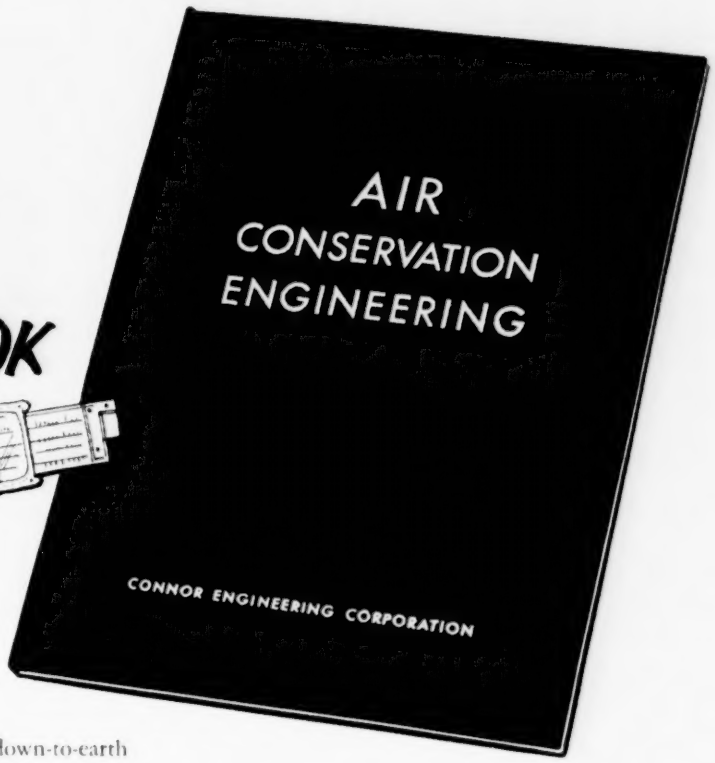
AMERICAN IRON AND STEEL INSTITUTE

350 Fifth Avenue, New York 1, N.Y.

NOW READY

NEW EDITION OF THIS FAMOUS HANDBOOK





Written out of 20 years of experience, this new edition of "Air Conservation Engineering" offers a wealth of factual information—latest theory as well as practical down-to-earth suggestions in this important field of engineering. A publication of Connor Engineering Corporation.

CHAPTER HEADINGS

- The Value of Air
- Basic Factors
- Air Recovery Procedure
- Activated Carbon and its Application
- Savings Through Air Conservation
- Application of Air Recovery Equipment
- Adsorption
- Control of Concentration by Air Recovery
- Air Quality Control in Refrigerated Storage
- Catalytic Combustion
- DOREX Air Recovery Equipment
- Typical Applications

Written by Henry Sleik and Amos Turk, Ph.D., the book has a handsome sturdy binding, 76 pages, 8½" x 11", profusely illustrated. Price only $5.00 postpaid. Mail your check with coupon below.

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NOTE TO LIBRARIANS: Copies of "Air Conservation Engineering" are available, *without charge*, to accredited technical libraries. Write us on your letterhead.

CONNOR ENGINEERING CORPORATION
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Enclosed is check for $. Please send postpaid copies of the new edition of "Air Conservation Engineering."

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POSITION.....

COMPANY.....

ADDRESS.....

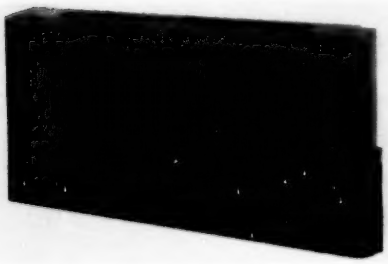
The Jefferson Standard Life Insurance Building would not compromise in its air conditioning!

Consulting Engineers: Watson & Hart
Mechanical Contractors: N. C. & W. H. Sullivan Co., Inc.

The particular system supplied by York for the Jefferson Standard Life Insurance Building in Greensboro, North Carolina, may not be the answer to your project . . . but chances are that York *has* the answer, and here's why:

York *has taken the compromise out* of air conditioning. Your York Engineer is not compelled to suggest that you change a project to fit a system, or force a system to fit the building you are air conditioning. With so wide a range of equipment, York can help you specify the precise installation that will deliver perfect performance at lower initial and operating costs.

There is a York Engineering office in every trading area with experts equipped to work with you from start to finish. A consultation incurs no obligation, of course . . . and can lead to appreciable savings in money, time and worry. Call your York office or write to York Corporation, York, Pennsylvania.



The York Induction Unit System in the Jefferson Standard Life Insurance Building in Greensboro, North Carolina, provides individually controlled climate for office occupants with these trim, modern units. Either heating or cooling supplied from the space saving central station situated in basement of building.

YORK AIR CONDITIONING AND REFRIGERATION
HEADQUARTERS FOR MECHANICAL COOLING SINCE 1885

For complete TUBE TURNS' service

CALL YOUR DISTRIBUTOR

Through your TUBE TURNS' Distributor you can get fast, local service and the right TUBE-TURN Welding Fitting and Flange for every piping need. There are more than 4,000 types and sizes in carbon steels, stainless steels, chrome-moly steels, copper, aluminum, brass, Monel metal, Inconel, nickel, wrought iron. Call him for this *complete, fast* service.

The mark of the Thoroughbred

Identification of genuine TUBE-TURN Welding Fittings is positive and permanent. Spot welded in place, this embossed steel tag shows Tube Turns' trade marks, size and wall thickness, ASTM specification, and weight. In addition, a laboratory control number is rolled into each fitting.

TUBE-TURN SEAMLESS WELDING FITTINGS • RANGE OF TYPES AND SIZES

TYPE OF FITTING (ALL DIMENSIONS IN INCHES)		CARBON STEEL						
		STANDARD WALL	EXTRA STRONG WALL	SCHEDULE 160	DOUBLE EXTRA STRONG WALL	SPECIAL SCHEDULES	LIGHT GAGE NOM O.D.	LIGHT GAGE I.P.S. O.D.
ELBOWS	90° Long Radius	½-36	½-36	1-12	¾-8	8-24	4-24	¾-12
	90° with Tangent	1½-12	1½-12					
	90° Reducing	2x1 6x3	2x1 6x3					
	90° Short Radius	1-30	1½-30			8-24		
	45° Long Radius	½-36	½-36	1-12	¾-8	8-24	4-24	¾-12
RETURNS	180° Long Radius	½-36	½-36	1-12	2-8	8-24	4-24	¾-12
	180° Ex. Long Rad.	1-2½	1-2½					
	180° Short Radius	1-30	1½-30			8-24		
TEES	Straight Outlet	½-30	½-30	½-12	½-8			
	Reducing Outlet	½-30	½-30	½-12	½-8			
REDUCERS	Concentric	¾ x ⅜ 24 x 16	¾ x ⅜ 24 x 16	¾ x ⅜ 12 x 5	¾ x ½ 8 x 3½			
	Eccentric	¾ x ⅜ 24 x 16	¾ x ⅜ 24 x 16	¾ x ⅜ 12 x 5	¾ x ½ 8 x 3½			
CAPS		¾-24	¾-24	1-12	1-8			
STUB ENDS	Lap Joint	½-24	½-24					
LATERALS	Straight Outlet	1-24	1-24					
	Reducing Outlet	1-24	1-24					
CROSSES	Straight Outlet	1¼-24	1¼-24					
	Reducing Outlet	1¼-24	1¼-24					
RINGS	Groove Type	¾-24	1-24		1¼-8			
	Ridge Type	¾-12	¾-12					
SADDLES[1]		2-24						
SLEEVES[1]		2-24						

[1] Since SADDLES and SLEEVES are used for external reinforcement only, they do not conform to Iron Pipe Size Thickness.

TUBE-TURN FORGED STEEL FLANGES • RANGE OF TYPES AND SIZES

TYPE OF FLANGE (ALL DIMENSIONS IN INCHES)		CARBON STEEL						
		150 LB	300 LB	400 LB[1]	600 LB	900 LB	1500 LB	2500 LB
WELDING NECK		½-24	½-24	½-24	½-24	½-24	½-24	½-12
SLIP-ON		½-24	½-24	½-24	½-24	½-24	½-24	½-12
LAP JOINT		½-24	½-24	½-24	½-24	½-24	½-24	½-12
THREADED		½-24	½-24	½-24	½-24	½-24	½-12	½-12
BLIND		½-24	½-24	½-24	½-24	½-24	½-24	½-12
SOCKET TYPE		¼-24	¼-4		¼-3½			
REDUCING	Threaded or Slip-On	¾-24	¾-24	¾-24	¾-24	¾-24	¾-12	¾-12
ORIFICE	Threaded		1-24	4-12	1-12	3-12	1-12	
	Slip-On		1-24					
	Welding Neck		1-24	4-12	1-12	3-12	1-12	

[1] Dimensions on sizes thru 3½ inch (except Orifice Flanges) same as for 600 lb. flanges.
[2] Dimensions on sizes thru 2½ inch (except Orifice Flanges) same as for 1500 lb. flanges.

Larger size fittings and flanges available. Specifications on request.

90° Short Radius Elbow

90° Long Radius Elbow

Reducing Outlet Tee

Straight Tee

45° Long Radius Elbow

Concentric Reducer

Eccentric Reducer

Lap Joint Stub End

180° Long Radius Return

Cap

Straight Lateral

Straight Cross

Welding Neck Flange

Blind Flange

Lapped Flange

Welding Ring

Threaded Flange

Saddle

Socket Flange

"tt" and "Tube-Turn" Reg. U. S. Pat. Off.

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558 BROADWAY • SALEM, OHIO

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CATALOG NUMBER	TYPES OF PUMPS	RANGE OF CAPACITIES
3300-B	Self-priming Centrifugal Pumps. Priming is rapid, automatic and fool-proof.	10 to 300 G. P. M. and heads to 250 Ft.
3900-B	Side suction Centrifugal Pumps. Single and Two Ball Bearing types.	Up to 200 G. P. M. Sizes ½", ¾", 1", 1½" and 2" discharge.
4010-A	Side suction Centrifugal Pumps. Single Ball Bearing. Electric motor, belt, or gasoline engine drive.	10 to 3600 G. P. M. Sizes 1" to 10" discharge.
4012-A	Side suction Centrifugal Pumps. Two Ball Bearing type with separate liquid end. All types of drive.	10 to 3600 G. P. M. Sizes 1" to 10" discharge.
4013-A	Side suction Centrifugal Pumps. Two Ball Bearing type. Electric motor, belt, or gasoline engine drive.	10 to 1200 G. P. M. Sizes 1" to 6" discharge.
4303	"Motor-Mount" Centrifugal Pumps. Can be mounted in vertical or horizontal position.	5 to 600 G. P. M. Heads up to 180 ft. 63 sizes of pumps.
4350	"Motor-Mount" Centrifugal Pumps. Vertical and Horizontal types. NEMA type "C" mounting flange.	Up to 200 G. P. M. Heads up to 165 ft. 25 sizes of pumps.
5004-A	Single stage, split case Centrifugal Pumps.	25 to 4000 G. P. M. Heads up to 300 ft. Full range of sizes.
4700	Vertical Multi-stage Centrifugal Pumps for wells 4" to 16" or larger.	15 to over 3000 G. P. M.
4600-A	Sump Pumps and Cellar Drainers. Various types including units with NEMA type "C" mounting flange.	Up to 3000 G. P. M. Full range of sizes.
4400	Condensation Return Units and Boiler Feed Pumps.	Wide range of sizes and capacities.
CATALOG C-52	A complete line of pumps and water systems for shallow and deep wells.	240 to 3600 gallons per hour and larger.

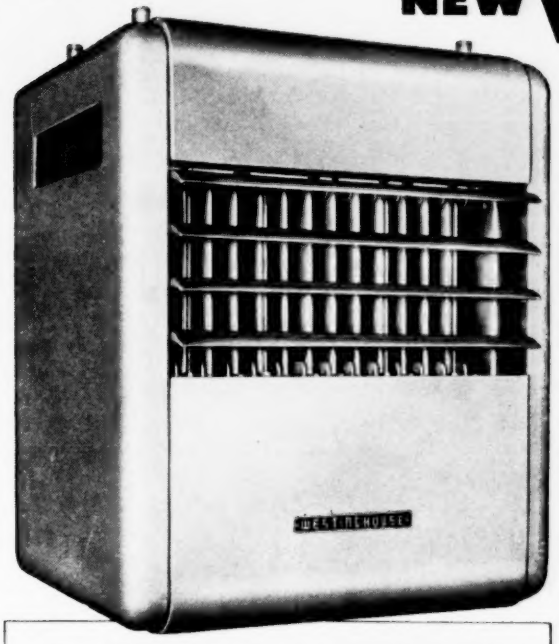
Pumps and Water Systems

Now Available

NEW Westinghouse

GAS-FIRED

SPEEDHEATER®



For store, office, factory or warehouse, check these 8 Westinghouse features:

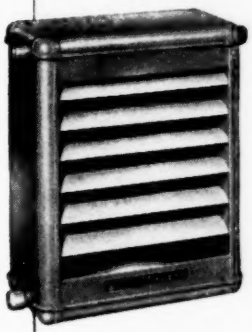
1. Instant on-the-spot HEAT
2. Automatic controls—no attendant needed
3. Ceiling suspension—uses no working space
4. No heat loss as in central plant piping
5. Swift, easy, economical installation; simple upkeep
6. Fully approved safety controls
7. Handsome, functional styling—no finishing cost
8. 7 sizes—25,000 to 200,000 BTU

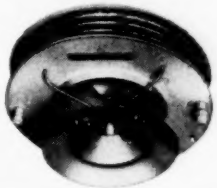
Heat starts right away—no long warm-up period. Self-contained, ceiling-mounted, the Westinghouse Gas-Fired Speedheater takes no valuable working space, needs no supervision, runs for low cost on natural, manufactured or LP gas. Adjustable louvres control distribution; fan will run separately for air circulation in summer. Get sure heat, save money on installation, avoid work, cut fuel bills—specify the new Westinghouse Gas-Fired Speedheater.

For full details on the Speedheater model best suited for you, call your nearest Westinghouse office for Catalogs 1521 and 1525, or write: Westinghouse Electric Corporation, Air Conditioning Division, Boston 36, Mass.

THE COMPLETE WESTINGHOUSE LINE

Meets Every Unit Heater Need





DOWNBLAST SPEEDHEATER

HORIZONTAL SPEEDHEATER

Get 7 times more output than conventional radiators; save money and space. In addition to the new Gas-Fired units, Westinghouse Speedheaters are available in 82 standard sizes in steam and hot water units. Capacities range from 25,000 to 400,000 BTU in horizontal and vertical models to meet every application.

WESTINGHOUSE AIR CONDITIONING

YOU CAN BE SURE...IF IT'S Westinghouse

J-80335

WeldELLS®

...have set their own standards

Many of the largest users of Welding fittings refuse to accept any other fittings than WeldELLS.

They have found that when the name, WeldELL, is stamped into a fitting, that fitting can be accepted without question for any service for which it is designed.

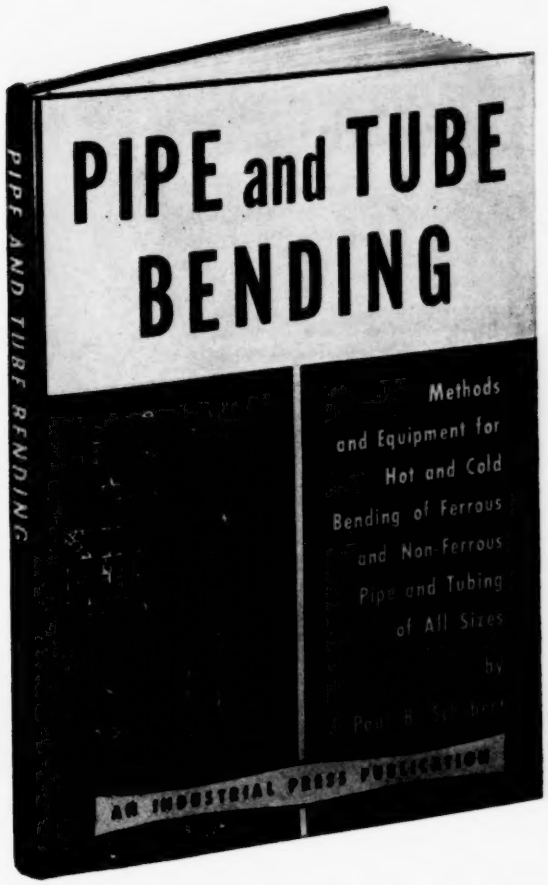
They have found that WeldELLS have features that please both the men who design and the men who erect welded piping . . . features that were pioneered by Taylor Forge . . . features that are combined in no other welding fittings.

They have found the answer to their every need in the greater range of sizes, weights and types of the WeldELL line . . . in the broader scope of materials.

For up-to-the-minute facts
See your Taylor Forge Distributor

TAYLOR FORGE

TAYLOR FORGE & PIPE WORKS, General Offices and Works: P.O. Box 485, Chicago 90, Ill.
Offices in all principal cities. Plants at: Carnegie, Pa.; Fontana, Calif.; Hamilton, Ont., Canada


PIPE and TUBE BENDING
Methods and Equipment for Hot and Cold Bending of Ferrous and Non Ferrous Pipe and Tubing of All Sizes
by
AN INDUSTRIAL PRESS PUBLICATION
PIPE AND TUBE BENDING

Introducing
A *New* BOOK ON AN IMPORTANT SUBJECT

Are you faced with a difficult problem in the bending of pipe or tube? Would you like to know which of the many different bending methods in use could be efficiently applied to your particular job? If you had the opportunity to look over the outstanding types of bending equipment which are now available and to study the operating characteristics of each would it save you time, money and headaches?

Pipe and Tube Bending **is an unusual book which is designed to do a specific job—to help designers, engineers, mechanics, in fact, anyone who is concerned with the bending of pipe, to do a better job. Here, for the first time, have been assembled the technical data and the practical know-how on bending both ferrous and non-ferrous pipe and tube in all sizes.**

Covering equipment and methods for pipe bending both in the shop and in the field, *Pipe and Tube Bending* illustrates the outstanding types of bending equipment which are available, describes the operating characteristics of each, and shows how each is applied to particular jobs. With this information, it is possible to compare methods and equipment and select those which are most suitable for a particular job.

In addition, *Pipe and Tube Bending* gives convenient formulas for determining length and minimum radii of bends, shows the effect the method of bending has on minimum radii, discusses in detail the use of fillers, mandrels, dies, etc.

Check this List of Subjects Covered!

- Methods of Bending
- Lengths and Minimum Radii of Bends
- Use of Fillers and Mandrels in Bending
- Compression Bending
- Draw Bending
- Ram and Press Bending
- Roll Bending
- Wrinkle Bending
- Hot Bending of Large Sized Pipe and Tubing
- Production Pipe Bending Using Wooden Forming Dies
- Pipe and Tube Coiling
- Bending Operations in the Field
- Procedure for Dimensional Drawing of Bent Parts
- Classification of Tubing

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159 Illustrations

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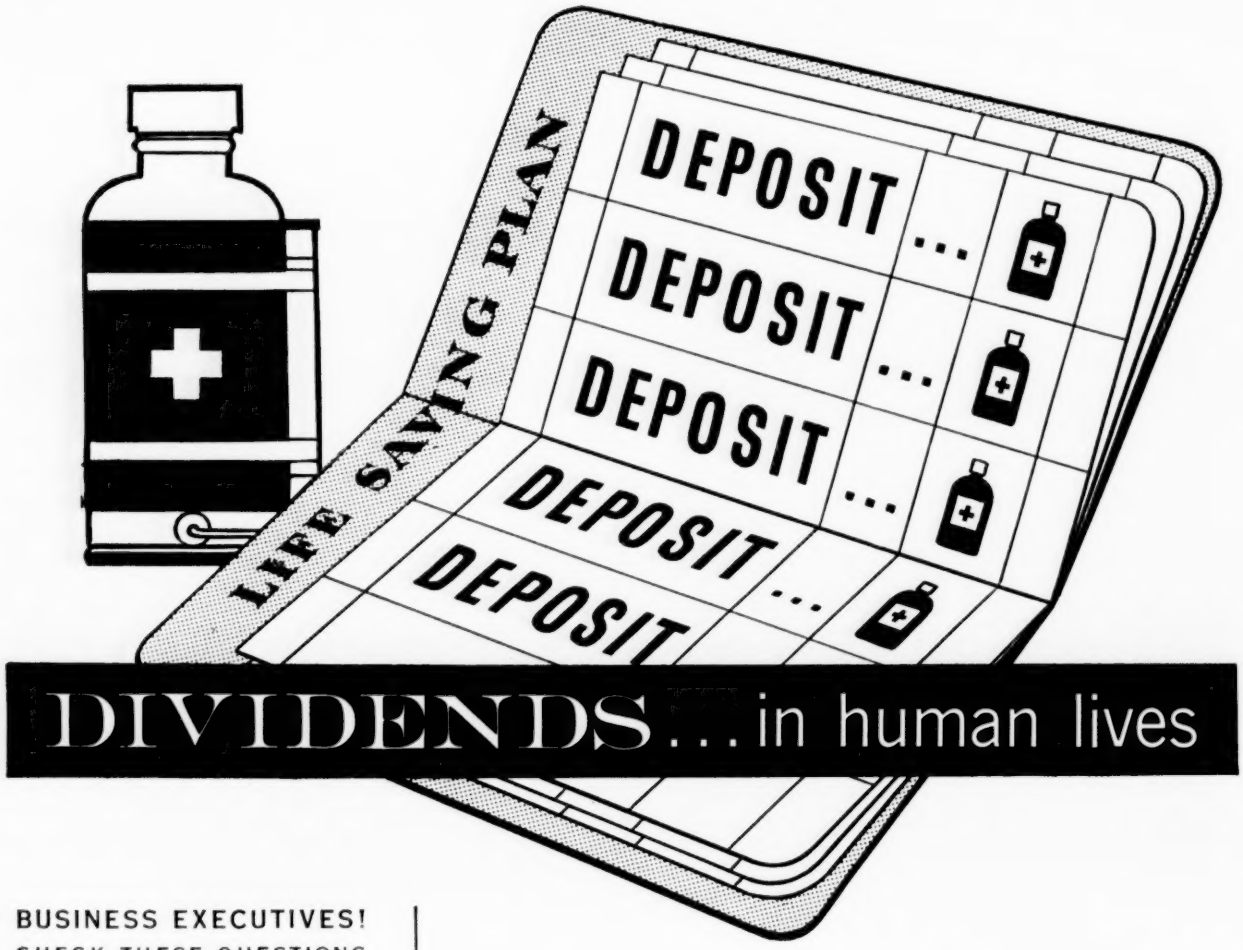

DIVIDENDS... in human lives

BUSINESS EXECUTIVES!

CHECK THESE QUESTIONS

If you can answer "yes" to most of them, you—and your company—are doing a needed job for the National Blood Program.

- ○ HAVE YOU GIVEN YOUR EMPLOYEES TIME OFF TO MAKE BLOOD DONATIONS?
- ○ HAS YOUR COMPANY GIVEN ANY RECOGNITION TO DONORS?
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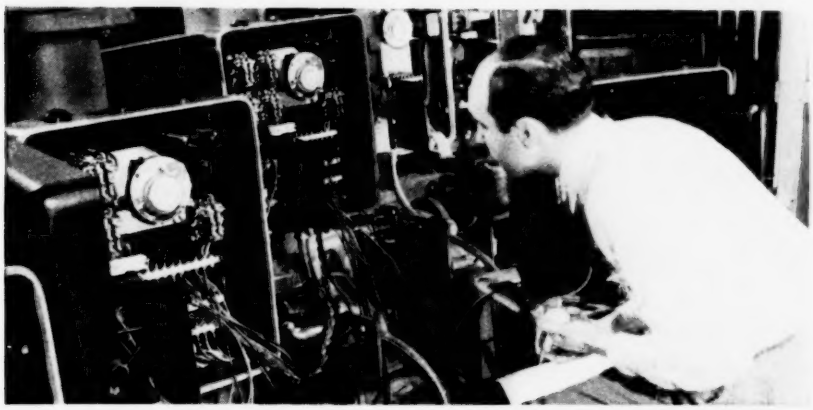

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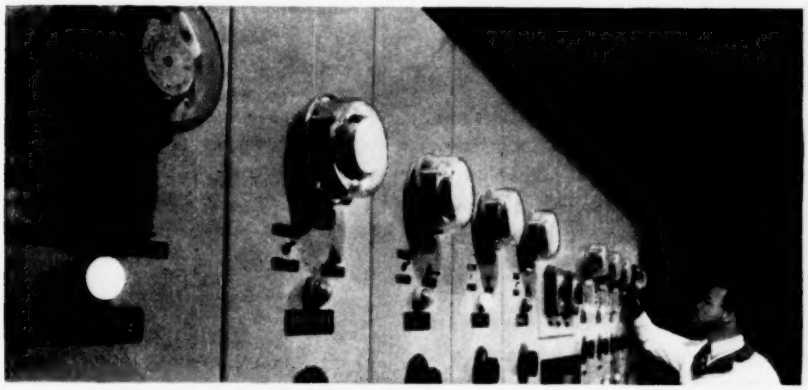

FOR ANY APPLICATION, whether on chemical processing (above) or machinery control, the G-E automatic TSA-14 timer can save valuable man-hours, reduce costs, increase production efficiency. For more information write for Bulletin GEC-525, to General Electric Company, Schenectady 5, N.Y.

605-166

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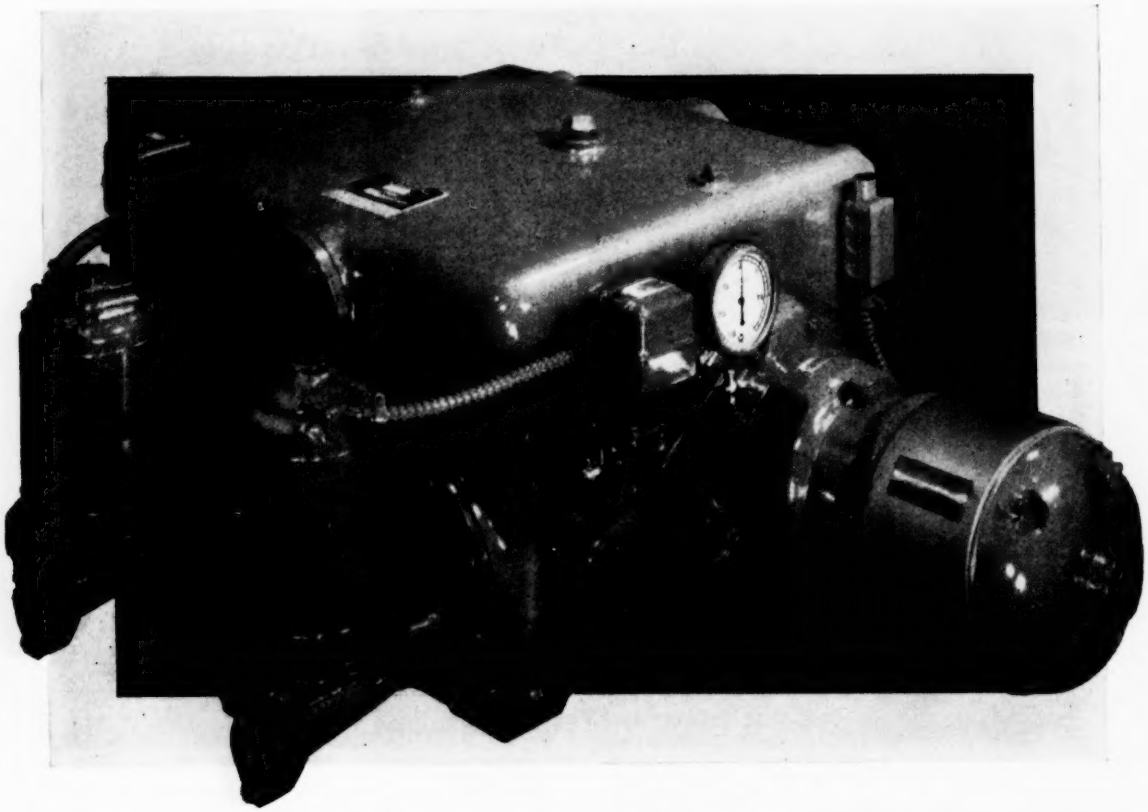

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- Increased air capacity induces rapid system response without wasteful overheating.
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- Flexibility permitting addition of radiation without changing basic pump installation.
- Low, low, return line connection.

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Heating Store and Building Entrances

LEWIS R. FULLER

Manager, Unit Ventilator Sales Department
The Trane Company, La Crosse, Wis.

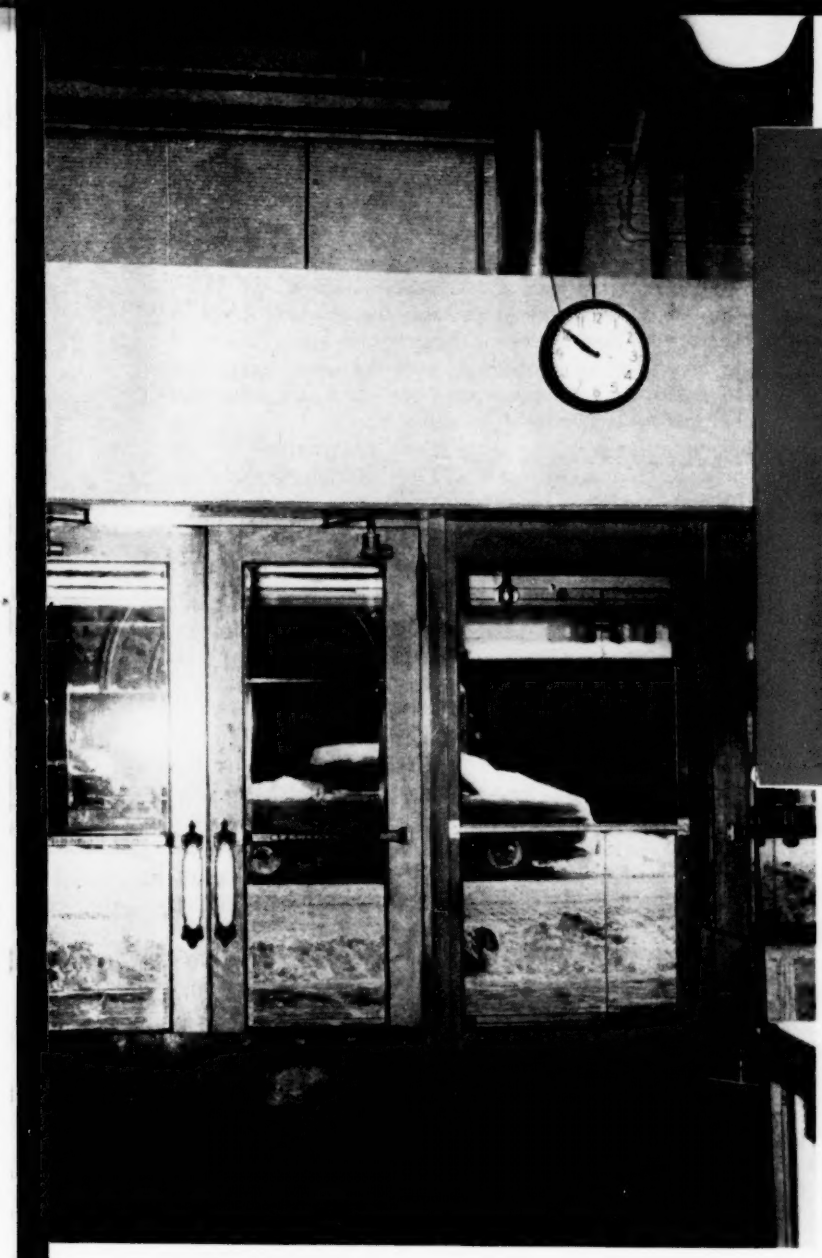

Fig. 1. Sidewall cabinet type unit heater in entrance vestibule.

Several arrangements are presented for effectively heating entrance ways. Data are given to determine the amount of heated air required for a particular store or bulding entrance.

BOTH building owners and store owners know that as one enters a commercial building, the first impressions obtained are the influential ones. Therefore, to help create favorable comment, it is important to estimate properly the heating requirements of entrances, and to select and install the most suitable heating equipment.

Unfortunately, there is no single heating system that will be most effective in all entrances. Each building and store has its own design and traffic problems that influence (1) the design of the entrance itself, (2) the heating system that must be geared for the traffic problem and (3) the other design conditions that affect the comfort of occupants and customers.

The number of times per hour that an entrance door is opened will be an important factor in the design of the heating system. Surveys have shown that this traffic factor is greatly dependent on the nature of the business of the building or store. Table 1 provides some typical values for the number of entrance passages per occupant per hour for various types of buildings.

The type of entrance is another factor to be considered in calculating heating requirements. Direct entrance doors, vestibule entrance doors and revolving doors will all allow different volumes of outside air into the building on each passage. Table 2 shows the infiltrations through entrance doors of various types.

Every heating system is designed around the outdoor design temperature and the indoor temperature requirement. In general, the entrance heating job is one of compensating for the inrushes of cold air that occur when the door is opened. The entrance heating equipment can do this either by heating the incoming cold air to store or room temperature, or by introducing enough heated air to balance the infiltrations. Most systems achieve the required room temperatures by the latter method—balanced incoming cold air with heated air.

A typical entrance heating system might be designed as in the following example:

Proper heating must be provided for an entrance to a

Mr. Fuller is a mechanical engineering graduate of Iowa State College. With the exception of a period over four years with the Corps of Engineers, U. S. Army, during World War II, he has been continuously with The Trane Company since 1939. He is manager of the Unit Ventilator Sales Department and he has had considerable experience to write with authority on the subject of heating entrance ways.

TABLE 1—ENTRANCE PASSAGES PER OCCUPANT PER HOUR FOR VARIOUS TYPES OF BUILDINGS

Banks	8	Department Stores	8
Barber Shops	4	Furriers	3
Brokers' Offices	8	Lunchrooms	6
Candy and Soda	6	Men's Shops	4
Cigars and Tobacco	25	Office Buildings	2
5 and 10¢ Stores	12	Public Buildings	3
Dress Shops	3	Restaurants	3
Drug Stores	8	Shoe Stores	4

NOTE: These figures were determined by surveys on time spent by customers to transact business in each type of building. To find this average time, divide the entrance passages shown into 60.

new bank building. The entrance will be a direct one into the main banking room. Outside design temperature is 10F, and the desired inside temperature level is 70F.

From Table 1, it is seen that the number of passages per occupant per hour for a bank building is eight. The average number of customers in this bank has been estimated at 30. People are constantly entering and leaving the bank. It has been determined that to maintain the normal occupancy a definite number of people will be entering and leaving any specified time. This figure is shown as "entrance passages per occupant per hour." With eight entrance passages per occupant per hour, and 30 occupants, there will be a total of 240 passages through the bank door each hour.

The amount of cold air infiltrating each time the door is opened can be found from Table 2. This is a direct entrance door, with 240 passages per hour. Thus, there will be 110 cu ft of air entering with each passage. In one hour this would amount to 240 × 110 or 26,400 cu ft of incoming air, or 440 cfm.

The heating system must have enough capacity to balance this volume and to maintain the desired indoor temperature of 70F. Generally temperatures of the air leaving the heating unit or the discharge grille should not be above 140F. Thus, this requirement must be kept in mind when heating requirements are calculated.

To Find Heated Air Required

To determine the amount of heated air required for a particular entrance, the following formula is often used:

$$A_1 = \frac{A_2 \times (T_1 - T_2)}{(T_3 - T_1)}$$

Where A_1 = Required heated air in cfm
A_2 = Inrushing outside air in cfm
T_1 = Inside design temperature
T_2 = Outside design temperature
T_3 = Leaving air temperature (140F or less)

In the example above, 440 cfm of outdoor air enters at 10F. Following the formula, this volume of cold air at this temperature calls for an additional 440 cfm at 130F to provide an indoor temperature of 70F,

$$\text{based on } A_1 = \frac{440 \times (70 - 10)}{130 - 70}$$

If the required leaving temperature were about 140F, it would be necessary to increase the amount of air in order to lower the leaving temperature. For instance, if the conditions in the example were the same except that the outside design temperature were —20F, a leaving temperature of 160F would be called for by following the formula. However, the same inside temperature of 70F could be maintained with a 130F leaving temperature if the volume were increased to 660 cfm.

Factors to be Considered

Once the heating requirements have been determined, the engineer can go on to the selection of the specific heating unit or system. Here, five factors are to be considered:

(1) Discharge temperature of air leaving unit
(2) Discharge velocity of air leaving unit
(3) Discharge pattern of air leaving unit
(4) Unit's volume capacity
(5) Size of unit

The importance of each of these factors depends, to a large extent, on the type of entrance being heated. In a small vestibule, for example, discharge temperature, cfm, and size of the unit are the most important considerations in selecting the proper system. However, in an entrance where a large doorway opens directly into the store, discharge velocity and discharge pattern are vital factors.

Entrance heating systems can be classified generally into three types: direct or convected heating, (Fig. 2); overhead blanketing, (Fig. 3); side wall vestibule type cabinet heaters (Fig. 4).

Heating Capacity of Unit

In buildings where traffic is relatively slow (up to 6 entrance passages per occupant per hour), and where vestibules are small, it is often possible to handle entrance heating with a direct or convector heating unit without forced air circulation. These units deliver their heat by direct radiation, as in cast-iron radiators, or by convection, as with convector radiators. To find the heating capacity of the convector or radiator required, the following formula is generally used:

TABLE 2
INFILTRATION THROUGH SINGLE SWING DOORS
(Doors in one wall)

Passages per Hour up to	Cu Ft Air Infiltration per Passage		
	Direct Entrance Doors	Vestibule Entrance	Revolving Doors, 6 x 7 ft
300	110	83	30
600	110	82	29
800	110	82	27
1,100	109	82	24
1,400	109	81	19
1,600	108	81	17

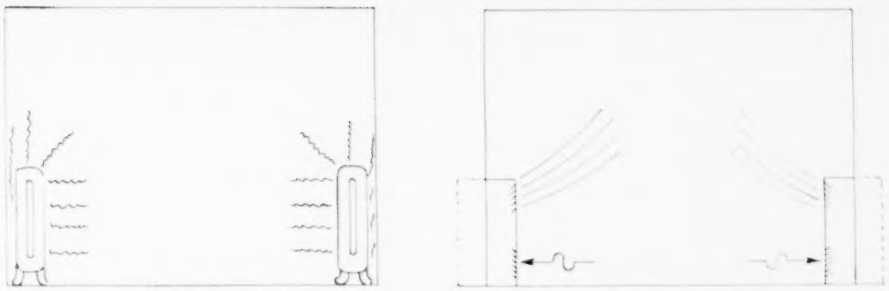

Fig. 2. Cast iron radiators, left, and convectors, right, are primarily adapted for vestibule type entrances with light traffic. Dotted lines show how convectors may be recessed into wall.

$$H = Q \times 0.018 \times (D - R)$$

Where H = total Btu heat requirements (required unit capacity)
Q = calculated cfm air requirements for entrance
0.018 = Btu required to raise 1 cu ft of air 1F
D = desired discharge temperature of unit
R = room design temperature (normally 70F to 80F)

In other words, we first find the number of cubic feet per minute of air infiltrating into the entrance. This is multiplied by 0.018, the number of Btu required to raise one cubic foot of air one degree Fahrenheit. This product is multiplied by the temperature rise required to get the total heat necessary to handle the entrance heating job. This final product is the capacity required of the heating unit.

Overhead heating units—projection, unit heaters, and wall cabinet unit heaters with ceiling duct outlets—are recommended for many types of vestibule entrances. See Figs. 1 and 5. Warm air from the units blends with the inrushing cold air above the heads of entering customers, thus eliminating objectionable air currents. Projection or down blast unit heaters used for this purpose should not ordinarily be mounted at less than 10 ft from the floor, or without some type of diffuser to provide full coverage of the entrance area. The cabinet type heater, with duct outlet at the ceiling, may be adapted for any reasonable ceiling height. In Fig. 3, an air diffuser is shown, with projection and cabinet type units.

Most unit heater manufacturers publish "maximum mounting height" tables for their units as well as recommendations for locating units for best coverage. If maximum mounting heights are not exceeded, enough mushrooming effect of the air stream will result at the floor to provide good air distribution.

Selection of cabinet type unit heaters is determined by the cfm and total heat requirements as will be shown. However, possible heat losses in the ducts should be considered as the unit's effective capacity is that measured at the duct outlet. Recommended mounting heights for various types of outlet diffusers for various volumes are provided in chart form by diffuser manufacturers.

Store buildings that have high ceilinged areas often provide low false ceilings in the vestibule. Here, it is possible to use down blast unit heaters mounted above the low ceiling, and connected to it by a duct. Air is taken from the store interior, heated by the unit, and distributed through outlets in the vestibule false ceiling. When cabinet type unit heaters are used in entrances, they should generally be located so that the warm air stream will not be released directly at the people entering the building. Unit outlets on the cabinet can often be pitched to send the air upward and overhead. See Fig. 4. The units may be recessed into the walls with a short duct in the wall, so that the outlet is eight feet or more above the floor. Normally these units take air in at floor level, but where the floor tends to be dusty or muddy, this may not be desirable. In these cases, inverted cabinet units can be employed, drawing air in at the top, and discharging heat at the floor.

Selection of cabinet type units for the entrance applications is based on heat and cfm requirements as determined by the heat loss calculations, and on the discharge temperature, velocity and pattern of the unit.

Empirical Formula

The following empirical formula states the relationship existing among throw, discharge velocity and grille area for cabinet unit heaters:

$$T = \frac{C \times Q}{\sqrt{A}}$$

Where T = throw, feet
C = constant for the unit
Q = rated cfm of unit
A = gross grille area (outside dimension), square inches

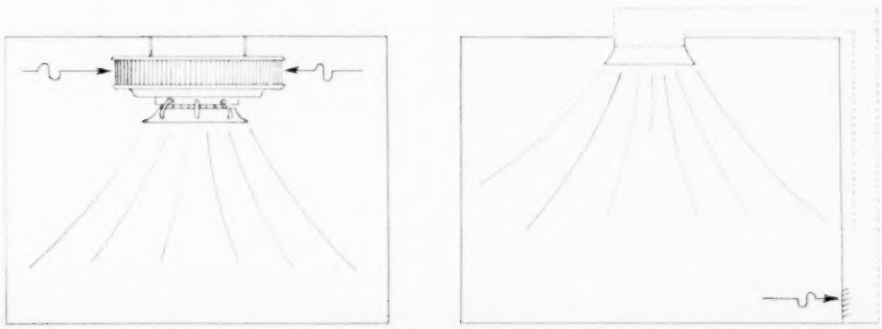

Fig. 3. Projection type unit heater, left, and cabinet type unit heater with ceiling outlet, right.

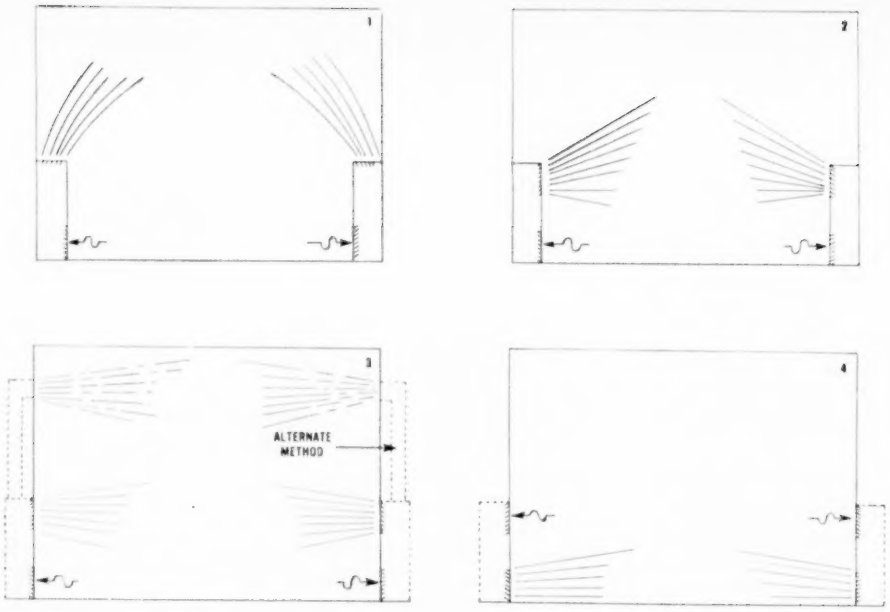

Fig. 4. Arrangements for sidewall cabinet type unit heaters for vestibule entrances.

Briefly, for a given unit, distance of throw will increase directly with an increase in discharge velocity or cubic feet per minute.

Unfortunately, it is not practical to work with absolute values of throw for the cabinet type unit in entrance heating applications. This is true because of the disturbing influence of incoming gusts of outdoor air and the interference of traffic.

A check of an installed unit during cold weather will enable the engineer to determine the throw of that unit to his own personal satisfaction. From that point, the formula will aid him in determining the expected throw from similar units at different speeds or cfm capacities.

If this problem of entry heating is encountered often, it may be practical for an engineer to establish his own personal values of C for each unit used in his base specification.

For example, assume that a pair of units delivering 400 cfm each through a 20-inch × 6 inch grille, by means of arrangement 2, in Fig. 4, is installed in a vestibule 30 ft wide and delivering the air to heat properly an entrance area in cold weather. The value of C can be determined approximately by a restatement of the previous formula.

$$C = \frac{T \times \sqrt{A}}{Q}$$

Using: T = ½ total width of vestibule (if 2 units are used) = 15 ft

Q = 400 cfm

A = 20 × 6 = 120 sq in

Therefore:

$$C = \frac{15 \times \sqrt{120}}{400} = 0.41$$

Now, if a unit from the same manufacturer is to be selected for a vestibule 40 feet wide, that unit can be checked against whether:

$\frac{20 \times \sqrt{A}}{Q}$ is equal to or greater than 0.41?

If it is, the resultant installation will be at least as satisfactory from a throw or coverage standpoint as the original installation which had been checked empirically.

It should be noted that (1) the value of C is a function primarily of the grille design, and can therefore be applied to all units of one manufacturer with the same type of grille, and (2) discharge temperature has no effect on throw. Throw is the really important factor in determining the discharge pattern. Spread of the air stream is relatively unimportant in this application because the blanketing is a result of proper forced air circulation with sufficient throw.

The main consideration with respect to discharge temperature is limiting it to a comfortable maximum. As mentioned earlier, discharge temperatures up to 140F are usually considered reasonable.

Heating Arrangements

Arrangement 1, of Fig. 4, is probably the most popular application of cabinet type unit heaters in vestibules. The air is directed over the heads of the patrons and can forcefully circulate the entrance air more effectively than the other arrangements.

Arrangement 2, on the other hand, offers a directly forward air stream. This may be desirable if the entryway is exceptionally wide, but it is restricted in its use due to the passage of traffic directly in front of the unit, interrupting the air stream.

Fully or partially recessed units, as shown in arrangement 3, are taken out of the traffic area and present a more attractive installation. The alternate method illustrated uses an elevated outlet and duct, and gives the overhead air distribution feature of arrangement 1, but without a cabinet in the vestibule area.

Arrangement 4 of Fig. 4 has come into favor in recent years. Again the recessed cabinet frees the area from obstruction. In addition, the reversed air flow with discharge at the floor level produces a beneficial psychological effect by warming the ankles and feet of the incoming patrons.

Combination of overhead and sidewall entrance heating

methods with multiple control can be used to blanket effectively practically any foot entrance.

Automatic control for the direct radiation and convector heating units in entrances is handled by a thermostat in the space controlling modulating steam valves or mixing water valves. Manual control is also possible, of course.

With overhead down blast unit heaters, and the cabinet unit heater systems described, both the drive motors and the steam and hot water supplies can be controlled. Manual control of the motor is not generally used, but the usual method is to operate the motor with an "on-off" thermostat and to provide heat to the unit continuously. This will help prevent freezing of water in the coil.

In general, thermostats in entrance spaces should be located in a neutral zone, so the direct effects of two or more units are equalized. Also thermostats should not be directly in the outdoor air stream or in the heated air stream from the units. If necessary, protective shields should be used. Thermostats should not be placed too high to prevent cold drafts at waist and ankle height.

Some types of buildings, such as variety stores, drug stores and specialty shops are often designed without a vestibule and with entrances directly off the street, or from deep show case windows. In these cases, the entrance heating problem is a part of the whole interior heating, and one solution to this problem employs a cabinet type unit heater built into a display stand facing the entrance. The unit draws air from behind the counter, heats its, and delivers the warmed air to the area around the entrance doors. Another satisfactory solution may be to use down blast unit heaters mounted directly above the doors. These units would be controlled by thermostats separate from the main stem.

Revolving door entrances present another problem in entrance heating. With these doors, infiltration of cold air is less than with single swinging doors, but there is still a distinct heating problem. When two or more revolving doors are installed in an entrance, a single cabinet unit heater, installed over the entrance, can heat both doors through a split duct. Air is taken from the interior of the building, and is delivered through outlets in the ceiling of the revolving door. The outlet would be located in the interior quadrant of the revolving door, so that infiltrating cold air is stopped just before it enters the interior of the store.

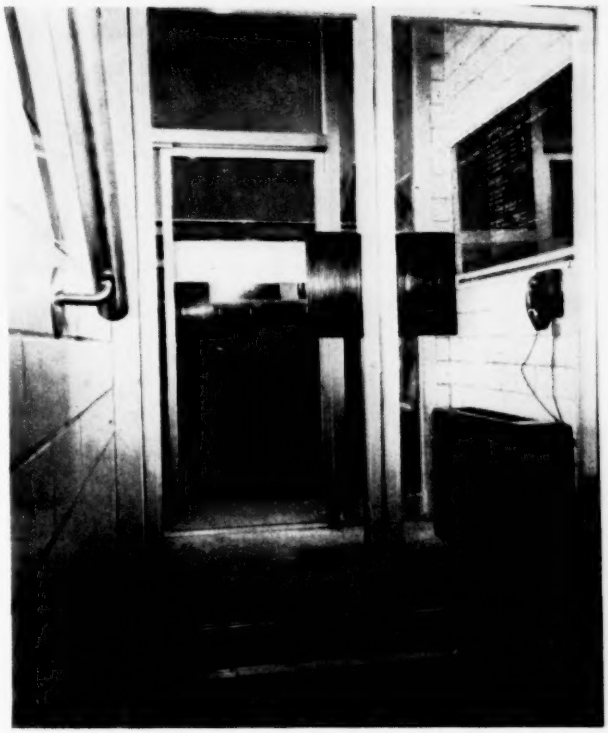

Fig. 5. Projection type unit heater used in an overhead blanketing heating installation in a vestibule type entrance.

Thermal Characteristics of Plaster Panels

Results of additional studies into the subject of thermal characteristics of plaster panels was presented at the semi-annual meeting of The American Society of Heating and Ventilating Engineers that was held in Denver, Colo. The investigation was made under the advisory guidance of the Technical Advisory Committee on Panel Heating and Cooling, as part of an overall research program that was organized to develop design data for panel heating and cooling systems. The paper was prepared by L. F. Schutrum, research fellow and C. M. Humphreys, acting director of research, of the society's research laboratory staff.

The importance of having good contact between the tubes and the lath and plaster in heating panels was illustrated by tests of two panels in which the tubes located above metal lath were wired to the lath at 8-inch intervals along each tube. The plaster was applied by an experienced craftsman and the embedment of tubes was judged by observers to be equal to field practice in one panel and superior in the other. Back-plaster was applied over the tubes in the average panel which then showed performance for the 8-inch tube spacing equal to that of 6-inch spacing without back-plastering.

The authors stressed the fact that the results of these studies will permit the design of a heating panel when the required heat output and the panel surface temperature have been determined. The application between these two variables must be established for each separate application. Data on the relationship between panel output and panel surface temperature are now being developed at the American Society of Heating and Ventilating Engineers Research Laboratory.

"It has been demonstrated," concluded the authors, "that for panels having tubes above metal lath, good tube embedment and good contact between tubes and lath are prerequisite to good heat transfer."

Temperature Control in Greenhouses

NORMAN J. JANISSE

Field Engineer, Engineering Department, Johnson Service Co., Milwaukee, Wis.

Acting on the one factor governing plant growth which is economically controllable, a variety of temperature control systems are at work raising the efficiency of production in greenhouses. Systems are classified by degree of complexity, and suggestions are made regarding the applications of each.

THE billions of green plants which cover a large part of the earth manufacture about 200 billion tons of produce annually, but at an efficiency as low as 2%. Plants use sunlight, carbon dioxide, minerals, and water to produce sugar and starch by a daytime process called photosynthesis. Both day and night, sugar and starch are converted by a chemical respiratory process during tissue growth. Light, temperature, and the availability of water and the proper minerals play an important part in the facility with which plants can grow and produce. Through rigid control of these variables, especially light and temperature, plant productiveness has been increased 10 to 15 fold under experimental conditions.

At present, there is no economical way to increase the duration or intensity of sunlight. There are, however, simple and rewarding arrangements for controlling space temperature.

Types of System

There are two basic types of temperature control system in use in greenhouses: the single-temperature system, chief function of which is to control at the desired night temperature, and the two-temperature system with separate day and night control points.

The simplest and least expensive of the two arrangements is, of course, the single temperature system. This system involves a simple room type thermostat controlling a valve on the heating source, which may be either steam or hot water.

In a glass house, while the sun is out, heat gain due to solar radiation reduces or eliminates the need for steam. Only on days when the temperature falls to the freezing point or below and clouds nearly eliminate the effect of the sun, will heat have to be added and temperature control required.

As this type of day occurs only during a part of the winter season, and because almost every night from September to June requires controlled heat to maintain desired temperatures, it is important that night temperatures be controlled.

Then, too, because much of the cell growth of a plant occurs at night, the night temperature is one of the most important controllable factors; many growers believe it is more important than daytime temperature, number of sunlight hours, humidity, or ventilation. Because of this need for control of night temperatures and because the majority of the total time that control is required occurs at night, that temperature is usually chosen as the set point for the thermostat rather than the 10 to 15 degrees higher daytime setting.

Mr. Janisse joined Johnson Service Co. in 1948, immediately after graduation from the University of Wisconsin with a B. S. in Mechanical Eigineering. His experience has been concerned with control applications and field research with emphasis on problems connected with control of air flow and special considerations in heating and ventilation of greenhouses. He served in the U. S. Navy for three years, 1942-46, with about two years in the South Pacific as radar operator. He is married and has one child.

On those days when control is required, the thermostat must be set to the desired temperature. While a single-temperature thermostat will take care of both day and night temperatures if it is manually readjusted to each required setting, such resetting takes manpower. If there are many houses and if resetting is required twice each day, the labor cost may be appreciable. For this reason, systems are installed with thermostats which permit automatic switchover to day or night temperatures.

This can be done effectively with a dual thermostat, like those commonly used in schools or office buildings, which can be switched automatically from the higher daytime temperature to the lower night temperature at a central panel. While such an arrangement eliminates manually readjusting individual thermostats, it is not quite the complete answer. With it, the changeover from day to night temperatures is accomplished suddenly. Rapid changes in temperature, besides not being normal to the plant's natural conditions, often produce severe stratification. These cold and hot layers of air often result in condensation on the leaves of the plants. In certain plants this condensation will produce mildew and will result in harm to the crop.

The rate at which this changeover should occur has been tentatively determined to be not more than 4 degrees F per hour. This rate has been determined experimentally by a humidity controller which permitted the temperature to fall only as fast as was consistent with absence of condensation within the area in which the plants are located. This rate is consistent with accepted practice among growers.

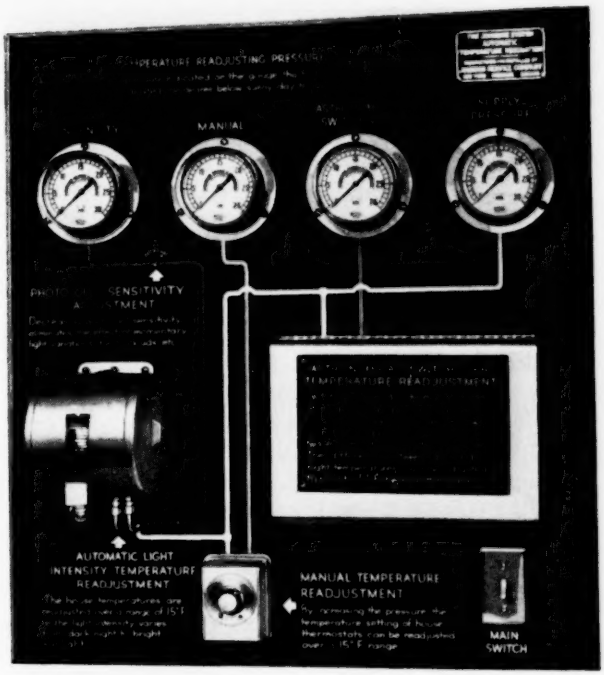

Fig. 1. Experimental central panel for temperature control in greenhouses.

There are three widely used methods of producing this changeover from a central panel or switchover station. All of them incorporate the use of submaster space thermostats which can be remotely adjusted to a new control point, usually by means of air pressure. The problem is then to produce a slow changing pressure which can be fed to the submaster space thermostat at the proper time to adjust the control setting and produce the slowly changing space temperature conditions.

Fig. 1 shows a panel installed in the Plant Science greenhouse at Michigan State College. Because the greenhouse is devoted to experimental and research work, the panel contains all three methods of readjustment. This is more elaborate than is required in commercial ranges. The single method to be chosen for a commercial job can be finally determined by results in experimental ranges such as these.

The simplest of the three systems shown on the panel is the manual arrangement. This incorporates a pneumatic gradual switch which permits the operator to adjust its output in small increments over the complete range of input pressure. Gradual temperature change results. Provision for setting the daytime temperatures at various values dependent on outdoor light conditions is also available at the central panel by means of the gradual switch.

To save man hours, a time delay could be built into this arrangement which would provide for the slowly occurring switchover. The second system incorporates this time delay and a clock to accomplish the switchover each morning and night. Since the time of sunrise and sunset changes each day and because the day and night temperatures must occur during the light and dark periods, respectively, an astronomical time clock is used. This type of clock effects a switchover at sunrise and sunset.

Since full sunny day temperature is not desired on cloudy or partly cloudy days, a daytime temperature limiting device should be incorporated in this system. Thus the clock can reset the thermostats from the night temperature to any value up to full sunny day temperature as selected by the operator. Then on cloudy days with a minimum of light present for photosynthesis, the process is not speeded up by excess temperatures.

Photoelectric System

In the two previous methods of switchover, provision was made for slowly changing the temperature at sundown and sunrise and for varying the daytime temperature to compensate for bright or cloudy day conditions. Both of these are a method of matching the greenhouse temperatures with the outdoor light intensity. Logically then, a method of directly readjusting the thermostats from light intensity is desirable.

In the third system, a photo electric cell sensing the intensity of the light outside the greenhouse, and varying the air pressure accordingly, provides the switchover or

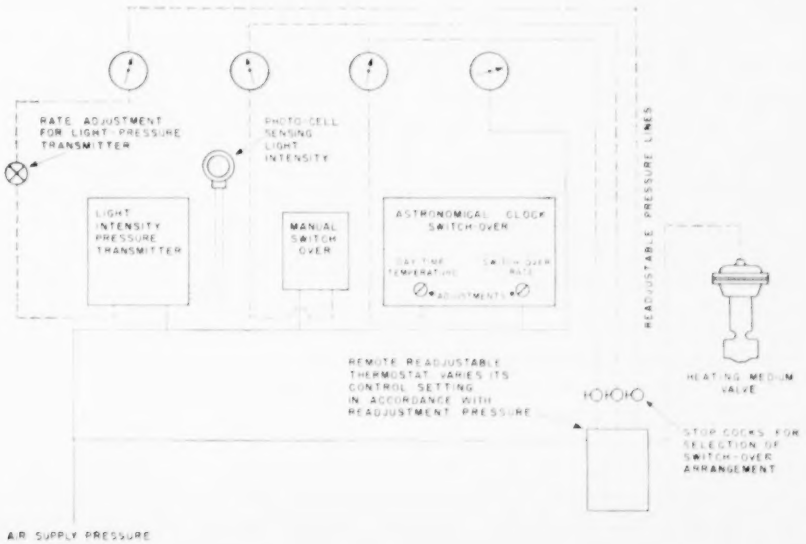
RATE ADJUSTMENT FOR LIGHT-PRESSURE TRANSMITTER
PHOTO-CELL SENSING LIGHT INTENSITY
LIGHT INTENSITY PRESSURE TRANSMITTER
MANUAL SWITCH OVER
ASTRONOMICAL CLOCK SWITCH-OVER
DAY TIME TEMPERATURE ADJUSTMENT
SWITCH-OVER RATE
READJUSTABLE PRESSURE LINES
REMOTE READJUSTABLE THERMOSTAT VARIES ITS CONTROL SETTING IN ACCORDANCE WITH READJUSTMENT PRESSURE
HEATING MEDIUM VALVE
STOP COCKS FOR SELECTION OF SWITCH-OVER ARRANGEMENT
AIR SUPPLY PRESSURE

Fig. 2. Layout of panel shown in Fig. 1.

readjusting pressure to house thermostats. This method provides slow adjustment at sunrise and sunset because of the normal lengths of dawn and twilight. It also automatically compensates for the variations in light intensity during the day, much more accurately and dependably than can a human operator. To prevent momentary changes due to occasional clouds, a time delay is inserted into the system. The change must then be prolonged before any effect is felt at the thermostat.

Fig. 2 shows the control layout of the systems shown on the panel in Fig. 1. Most commercial growers will probably select only one of these methods of switchover. This choice should be carefully made after considering all of the influencing factors.

Choosing the Proper System

The type of system to be selected will depend on many factors besides a purely financial consideration. The economy in various systems makes the initial cost in many cases a minor factor. The following is a list of factors which will influence the selection of a system for a particular greenhouse.

The choice between a single-temperature or a two-temperature system depends on:

(1) The size of the range. In a large range with many houses which may require resetting to accomplish the switchover, a two-temperature system would be economical. In small establishments, however, little time would be consumed in readjusting the individual thermostats.

(2) Whether or not an operator is on duty during the switchover hours with adequate time to change the thermostat setting at each thermostat, and what it costs to have him perform this function.

(3) Location of the greenhouse. In the warmer climates the possibility of requiring heat during the daytime is quite remote and the importance of daytime control is negligible. However, further north, many winter days require heat and also control.

Choosing the changeover or switchover mechanism if a two-temperature system is selected is not merely a matter of size of the establishment and the climatic conditions in the area. The simplest and least expensive system, the manual system, is selected if:

(1) A fireman or operator is on duty during the switchover period so that it does not require extra help to perform the switchover function.

(2) The operator is reliable enough to appreciate the value of the various rates of changeover.

Astronomical Switch-Over

More complicated systems, such as the astronomical switchover arrangements, are chosen when:

(1) Automatic switchover will eliminate the services of an operator or relieve a fireman to perform other duties.

(2) Extremely slow changeovers are required which might necessitate constant vigilance by an operator for several hours.

(3) The moisture condensation due to stratification can be harmful, such as on roses, and no other method of relieving this condition is provided for.

(4) An operator is on duty during the daylight hours so that the daytime temperature can be manually adjusted in accordance with outdoor light condition.

The most completely automatic system, that which is readjusted in accordance with the light intensity, is justified when:

(1) All of the above advantages are required or desired and the cost of doing all these things automatically can be justified by the increased quality of production or by the saving in man hours usually spent readjusting and setting individual thermostats, or operating the central panel.

Choosing the Thermostat

As in any building, the heating plant must be sized for design temperatures. Since this temperature prevails only a small percentage of the time, the heating plant is too large most of the heating season. Hence, the response to a demand for heat is rapid except on the coldest days.

Unlike most buildings, however, the large expanse of glass area results in a very high radiant loss of heat. This, coupled with a high convection loss due to loose construction of the glass walls and lack of insulation, results in rapid cooling when heat is shut off.

Because the building responds rapidly to the demands of the control system, it is important that the thermostat be chosen with a response that is equally rapid. For this reason most thermostats recommended for greenhouse work have thermal elements of very low mass, such as a bimetallic strip, and are protected by a cover open at the top and bottom producing a chimney effect which provides good circulation over the element.

The steam or hot water coils being fed by the automatic control valve are usually long compared to ordinary heating coils and hence a very slowly modulating valve could produce temperature variations along the coil and permit large temperature differences at opposite ends of the house. To prevent this, thermostats which change the valve position over its extremes in a very small change in temperature are selected. This means that in a pneumatic system a proportioning thermostat with a very high sensitivity (change in valve pressure for each degree change in temperature), or a two position thermostat with a very narrow differential, should be selected. If an electric system is chosen, a narrow differential thermostat must be used.

Shielding

The thermostats that have been selected should be properly shielded so that dirt and condensed moisture cannot drop in the working mechanism. An example of such an arrangement is shown in Fig. 3. These thermostat panels should be mounted in a location and position which eliminates the chance of spray from the bench watering devices. They should also be mounted so that they face north to prevent the ther-

Fig. 3. Thermostat.

mostat from sensing a false temperature due to radiant heat gain from the sun. However, if turning the thermostats to the north prevents easy accessibility, turning them in the direction in which they receive the maximum amount of shade will be acceptable.

Care of the System

After the proper control system has been selected and the grower is satisfied with its operation, the responsibility of the manufacturer or installer of the controls has ended unless a mechanical failure can be directly traced to equipment or method of installation. For this reason, it is important that the system be properly installed.

Much of the radiant effect on the thermostat can be eliminated by finishing the thermostat cover and panel with a reflective surface. This is especially important if the thermostats cannot be faced in a northerly direction. Painting with a reflective aluminum or white paint is usually sufficient.

The thermostat cover should be equipped with a thermometer to aid the operator in making a frequent check on the operation of the control system. These thermometers will also assist the grower in determining when roof ventilation is required to aid in reducing daytime temperatures. Due to the extremely high temperatures in the houses during hot summer days, these thermometers must be protected to at least 120F.

Proper installation, however, is not the only precaution which must be taken to assure good control. Properly operating controls on a well installed heating system are good only as long as the system is kept in repair. Steam traps and other parts of the mechanical equipment should be checked at least once each year.

Economy of Temperature Controls

According to a census taken in 1950, the average expenditure for fuel among 1300 growers of flowers or vegetables was over $1,500 in that year. These greenhouses, half of which were located in North Central and Middle Atlantic states, varied in size from very small establishments to some as large as 2,000,000 sq ft of growing area. Fuel constitutes a large part of the expenses of each establishment, and a saving on this item, therefore, would represent a large decrease in total expenses.

One large greenhouse which kept fairly elaborate records of fuel consumption over a ten year period used approximately 3,000 tons of coal per year. Automatic temperature controls were then installed, and during the first year, which was near average on a degree day basis, less than 2,250 tons were burned. This constitutes a saving of over 750 tons or 25% of the total.

Average Saving

For the average grower included in the census figures, a comparable saving would amount to approximately $375 per year, which would amply justify the initial cost of an automatic control system on the basis of fuel savings alone. This, as has been pointed out, is only one of the economic factors which must be considered. Automatic control reduces manpower costs, produces better control of plant growth, and reduces the danger of having a crop of flowers in bloom either before or after the occasion for which they were intended.

Increasing the control setting of a thermostat as little as two or three degrees, for a few weeks before the desired maturity date, could speed up a crop of lagging flowers to bring them to maturity on time. On the other hand, reducing the temperature a few degrees will slow down the growth enough to prevent premature flowering. This, of course, is quite easily understandable as most plant reactions are chemical in nature and an increase in temperature usually increases the rate of a chemical reaction.

Production control is only one of the advantages of eliminating the unreliable human element from the control of space temperatures. Quality control is as much an economic consideration to growers as it is to the manufacturer of a precise instrument. For instance, temperatures too high at night may produce excessive growth of a flowering plant, resulting in stems too long and too weak to hold the flower, or too long to be attractive to the purchaser. The production of vegetables hypersensitive to temperature, such as tomatoes, cucumbers, etc., also can be seriously affected.

Other Controllable Factors

Other factors besides temperature have been successfully controlled. Humidity, important in the growing of some tropical plants and a serious threat to many flowering plants when it gets out of hand, has been economically controlled in several ways. Humidity controllers may be made to operate the roof ventilators to control humidity over a limited range. This method has many limitations but is usually sufficient for most greenhouse applications. With the great number of air changes per hour usually experienced in greenhouses, an artificial humidity control system would be costly and impractical in large commercial houses.

Ventilation too is controllable and many hours of labor at the crank of the roof ventilator can be saved. Automatic operators can be applied and controlled from a central source or directly by the thermostat or humidistat in the space. These ventilators can be arranged to be closed from central location in case of strong winds or rain, thereby relieving the attendant of worry and rush when storms arise.

Light

Light, one of the very important factors in plant growth, is the most difficult factor to control. Commercially, it is not economical to do; however, it has been done experimentally with great success.

Light, however, does influence selection of the control temperature during the dark hours. After a series of dull days, which means decreased production of sugar through photosynthesis, the night temperature must not be too warm or the plant will attempt to use up more of the products of photosynthesis than are available. As it is yet uneconomical to increase the light intensity during the daylight hours, we can decrease the night temperatures and slow down reactions which use up the products of photosynthesis, thus producing a better balance for production of top quality plants.

Design Factors in Catalytic Fume Elimination

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From the field experience of four years and several hundred production installations, the potential and limits of catalytic fume combustion can be predicted with a reasonable degree of accuracy. It is the purpose of this report[1] to review the function of the catalyst, define the limits of adaptability, specify results obtainable, and outline design factors of a complete catalytic fume combustion system.

EARLY development work on the use of catalysts for fume combustion was motivated by the concept of energy reclamation. The oxidation of any hydrocarbon or organic gas causes heat liberation as well as conversion of the noxious fumes to innocuous carbon dioxide and water vapor. For example, a typical industrial paint baking oven may exhaust 10 gallons of solvent per hour. It is obvious that the release of fuel energy in the exhaust stream—on the basis of a heat of combustion value of 120,000 Btu per gallon of solvent—represents a significant heat recovery potential of 1,200,000 Btu per hour. The number of installations, where fume elimination simply becomes a by-product of energy recovery, is constantly increasing.

Definitions

The Catalytic concept of fume elimination requires the employment of terms and expressions infrequently used in other air pollution control work. For convenience, the following simplified definitions are listed:

Catalyst. A substance which, simply by its presence, accelerates a reaction without itself entering into the end products of the reaction. As applied to fume combustion, the presence of the catalyst permits union of oxygen and hydrocarbons in a fume stream at approximately 500 F, when in its absence probably 1400 F would be required for the same reaction. Since the catalyst does not become part of the end products, its life is theoretically infinite.

Fume Energy Concentration. The latent heat energy in a unit volume of fume stream, usually expressed as Btu per cubic foot of 70 F equivalent air (Btu per scf). By thermal capacity of dry air, the release of each Btu per scf will produce increments of temperature rise to the fume stream of aproximately 57 degrees F. Therefore, the combustion of a fume stream having an energy concentration of 10 Btu per scf will produce a temperature rise to the fume stream of 570 degrees F.

(Right) Battery of catalytic fume combustion units at Reichold Chemicals, Inc., Detroit, has been operating 24 hours per day for three years.

Lower Flammable Limit—L.F.L. or L.E.L. The lowest concentration of a mixture of flammable vapor or gas in air (usually expressed in percent by volume) in which a flash will occur, or a flame will travel, if the mixture is ignited. A point-source of high temperature is required to initiate the chain reaction. Over 600 flammable gases are classified indicating L.E.L. ranges from 1% for carbon disulphide to 4.1% for hydrogen. These variations undoubtedly result from differences in molecular weights and oxygen demands, since the Energy Concentration for all flammable gases at the L.E.L. appears generally constant—on the order of 50 Btu per scf at room temperature.

Catalytic Ignition Temperature. The minimum temperature to which a fume stream must be raised to initiate catalytic combustion. Platinum alloy catalysts are employed for their recognized stability, low ignition temperature, and resistance to elevated temperatures. At operating velocities, catalytic ignition temperature may vary from below 300 F for alcohols to as high as 600 F or more for the vapors of tar and asphalt. Variations in energy concentration from traces to 3 or 4 Btu per scf produces no significant change in catalytic ignition temperature.

Oxidation System

In the sequence of fume movement from its source of generation in a manufacturing process to the discharge of the oxidized gases, a complete system generally incorporates the following parts:

(1) *Fume collection and delivery.* This may consist of an exhaust fan on a paint baking oven, or tight fitting hoods and fume collection ducts on kettle cooking operations.

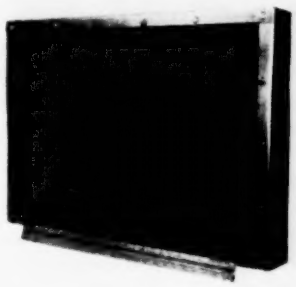
(2) *Fume preheating equipment*—required whenever the process exhaust gases are below the required catalytic ignition temperature. Preheating can be accomplished by oil, gas or electric heating.

(3) *Temperature Control* and Limit Protective Devices. In addition to controlling the preheating equipment, it may on occasion, be necessary to control Fume Energy Concentration and oxygen supply, by air dilution or by other methods, to maintain concentrations within prescribed safety standards.

(4) *Insulated housing* with Catalytic elements.

(5) *Heat recovery* or self-recuperative systems.

The catalyst element is similar in appearance to a metallic air filter mat. The supporting medium for the precious metals consists of a nickel alloy ribbon fill supported between nickel alloy container screens, all enclosed within a heat resisting alloy channel frame. A coating of platinum alloy metal is bonded to the nickel alloys and conditioned for activity. The construction permits high thruput capacity, low resistance to flow, high heat resistance, permanent distribution of the catalyst surface area, and resistance to thermal or mechanical shock. Standard elements are conveniently installed in banks for any desired fume volume.



The activity life of such catalysts has not yet been fully explored. Several units have now exceeded 23,000 service-free operating hours, and many units, checked after 10,000 hours of operation, show no measurable reduction in activity. It is expected that over long periods, normal attrition will cause activity to decline. When this occurs, the elements may be reactivated on an exchange basis, at moderate cost.

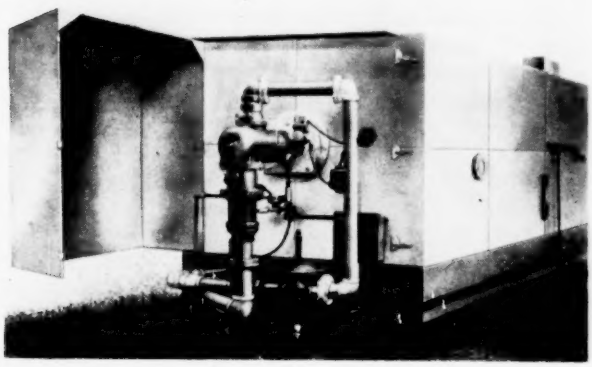
Range And Limits of Application

Catalytic oxidation is broadly applicable to hydrocarbon and organic type fumes, including alcohols, esters, ketones, ethers, acrolein, and aldehydes, as well as hydrogen, carbon monoxide and mercaptans. Equally satisfactory results are obtained with the low boiling group as well as the dense, heavy vapors liberated in the cooking of oils, tars and asphalt. Preheating prior to catalysis causes the visible aerosols to return to a gaseous state, thereby preventing condensate formation.

From the standpoint of initial cost, there are no serious volumetric limitations. Several systems have been supplied for volumes as low as 20 cfm and others, with capacities of over 20,000 cfm.

Because of the requirements for preheating to catalytic ignition temperature, operating costs may increase directly with the volume, but inversely with fume energy concentration. As an example—a 10,000 cfm, self-recuperative catalytic combustion system, receiving fumes at room temperature, having an energy concentration of 4 Btu per scf would be essentially self-sustaining, on a continuous basis, requiring no external heat. The same system handling an air stream containing an energy concentration less than 0.1 Btu per scf would require an operating consumption of approximately 2,400,000 Btu per hr.

The limits of adaptability from the standpoint of energy concentration or continuity of the fume load is



Catalytic fume combustion unit with gas preheat burner as used for heat-set ink fumes in the printing industry.

again, primarily economic. For those applications where the fume concentration is constantly within the flammable range, direct ignition by flame, without use of catalysts, appears to be the logical procedure. Catalytic Combustion Systems have already proven their use over several years of operation on fume streams which may fluctuate below, within, and above the flammable range, such as the exhaust from hooded varnish cooking kettles.

The process is considered unsuitable for use where the fumes contain large amounts of cinders, inorganic solids, or vaporized metals that would cause rapid deterioration of the catalyst, as in foundry cupolas, blast furnaces, or coal-fired boilers. However, normal atmospheric dust causes no difficulty, and in some cases, low concentrations of process inorganics can be tolerated. In general, observation of the manufacturing process generating the fumes will indicate whether permissible concentration of inorganic solids may be present in the exhaust stream.

Although their use is comparatively rare, some types of halogenated hydrocarbons are harmful to the catalyst. The temperature of the fume generating process may influence their presence in the exhaust stream. Where questions exist as to suitability of the process, pilot units are connected to the exhaust stream in the field. The accumulated data from several hundred pilot plant installations are helpful in predicting results.

Operating Results

Published reports by independent authorities have credited the catalyst with complete removal of organics in atmosphere, to as low as zero scale deflection on an infrared spectrometer. This same result can be accomplished where necessary for instrumentation purposes and for laboratory work. However, for full scale production installations, expected combustion efficiencies will vary from 97.5% for fume energy concentrations of 1 Btu per scf, to high efficiencies for higher fume concentrations. Physical inspection of the effluent stream normally shows:

Color ..... None.
Eye irritants ..... None, or slight trace.
Condensate in exhaust ducts .... None.
Odor ..... Non-objectionable.

Results as tabulated above are being obtained on production installations that have been operating for 6 months or more for such process exhaust applications as:

Foundry core-baking oven using linseed oil and similar core binders.
Oil cooking kettles—animal, vegetable, mineral, and fish oils.
Alkyd resin cooking kettles for paint manufacturing.
Phenolic resin curing oven.
Dryers of high speed paper printing presses, using heat set inks.
Oil burn-off furnace used in vaporizing kerosene and light oils from transformer punchings.
Kiln for firing wax-bonded ceramics.
Organic chemical plant manufacturing phthalic anhydride, with gases containing maleic anhydride, phthalic anhydride, naphtha quinone and naphthalene. Wire enameling ovens, with gases containing xylols and coal tar derivatives.

Mr. Ruff is a graduate of the College of Engineering, University of Wisconsin. He was Professor of Industrial Engineering at the Detroit Institute of Technology until 1943. During this period and for several years following, Mr. Ruff was closely associated with the industrial heating field in the design and manufacture of industrial ovens and furnaces. In 1945, with H. R. Suter, associated research director of Wyandotte Chemicals Company, Mr. Ruff initiated a research program on the disposal of combustible type fumes, which led to the invention, refinement and widespread application of the catalytic combustion process.

Standardization of catalytic combustion systems has now been adopted for several fume combustion applications. This has been accomplished primarily in the wire-enameling field, and on kettle cooking operations where either the processing equipment, or method of processing is essentially the same from one manufacturing plant to another. However, because of the wide variance in factors influencing the designs of the complete system, it appears evident that the majority of the installations will continue to require individual engineering study and design. A field study of a potential application, prior to design development, includes investigation of:

(1) Manufacturing process causing fume generation.

(2) Nature of fumes, their rates of liberation or cyclical behavior.

(3) Exhaust volume requirements of the process. In some cases, the volume of diluting air can be materially reduced with safety, thereby increasing fume energy concentration, reducing volume, equipment, size, installation and operating cost, while improving the opportunity for profitable heat recovery.

(4) Control and safety equipment existing on the fume generating process, and possible desirability of interlocking with the safety controls of the catalytic system.

(5) Presence of condensate in existing exhaust lines to determine the need for elimination of such hazards.

(6) The opportunity and potential use for reclaimed heat, where fumes have high energy concentration. This may involve further studies on heating requirements for plant make-up air, steam generation or adjacent drying operations.

Summary

All too often air pollution is viewed as contamination primarily from soot, fly-ash, and other forms of solid matter. However, analyses of smogs causing irritation to the eyes, nose and respiratory tract, as well as damage to crops and reduced visibility, prove that major pollutants are frequently hydrocarbons, or their products of decomposition, present in the form of gases and aerosols. By fortunate circumstance, harmless end products result from the complete combustion of hydrocarbons. Through the development work of the past four years, during which the range of applicability for effective and economical utilization of catalytic fume combustion has been established, industry's heating and ventilating engineers are given new responsibilities and opportunities in the field of air pollution control.

PROGRESS OF THE HEAT PUMP DURING THE PAST DECADE

PHILIP SPORN and E. R. AMBROSE

HEATING and VENTILATING'S REFERENCE SECTION

Progress of the Heat Pump During the Past Decade

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Considerable progress has been made during the past decade in the design of the heat pump and its use. As the result of research and study, there have been improvements in the heat pump operating cycle, assembly of the self-contained unit, and in operating efficiency. This article covers changes in design and betterments as well as operating data.

ALMOST a decade has passed since the heat pump and its future possibilities as an all-electric year-round air conditioning system were reviewed in the first of a series of articles on Blueprints of Post-War Realities (HEATING AND VENTILATING—January 1944). Accelerated heat pump activity was anticipated in the immediate post-war period because of the potentialities offered by the increased plant capacity of equipment manufacturers and by the greatly expanded electric generating facilities which resulted from the productive efforts of World War II.

The heat pump market did not, however, develop during the intervening period as expected because of the many resulting factors which discouraged the consideration of a new product. These factors include the difficulties experienced in converting to peace-time operation after V-J day, the subsequent boom in conventional air conditioning equipment, and the beginning of the defense effort which followed the Korean invasion. Another and perhaps equally important contributing factor to the slow progress of the heat pump during this period was the electric utility industry and coal industry's lack of aggressive research of a device which holds great promise for making coal generated electricity the primary and perhaps ultimately the only form of energy utilized in the home. Apparently, the tremendous expansion in demand for electric power, which started during World War II and which has continued practically unabated to date, was not conducive to creating or promoting another electric energy consuming product, even one as promising as the heat pump.

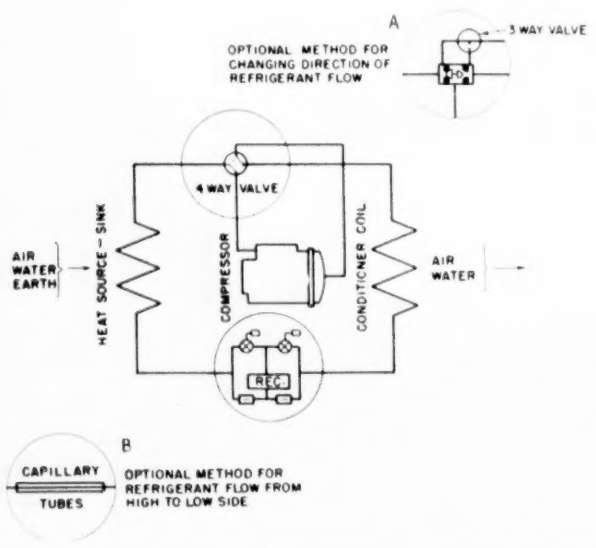


Fig. 1. Basic flow diagram for changing direction of refrigerant flow to obtain heating and cooling. Optional methods are shown at A and B.

Market Is Improving

The heat pump position should materially improve, however, in the near future because many of the deterrent factors which have faced the three industries are fast disappearing. In addition, a vast potential market is rapidly developing, due to the wide public acceptance of year-round air conditioning in the residential and commercial fields. All of these favorable conditions should certainly provide the necessary incentive for manufacturers, electric utilities, coal industry, architects, and contractors to devote considerably more time and effort to creating and stimulating greater activity in the heat pump.

With the proper amount of development and exploration, the heat pump should assume an important position in the commercial and residential year-round air conditioning field because of its many desirable features. It is compact, flexible in operation, readily applied to any air conditioning distribution system, and can be easily adapted to the size, shape, and architectural treatment of the structure. Also, due to the absence of fuel-fired equipment and accompanying products of combustion, the equipment can be safely located anywhere in the structure as a central plant or as a number of self-contained packaged units. The ability of the heat pump to furnish both heating and cooling to different areas simultane-

ously, as well as to cycle daily or even hourly between heating and cooling during mild weather, makes it particularly attractive as a year-round air conditioning system.

The progress of the heat pump during the past nine years may be somewhat disappointing when judged solely by the relatively small number of existing installations. The progress, however, is not too discouraging when all of the experimentation and testing which have taken place are included, particularly in the residential field in order for the manufacturers and other interested parties to determine the design and installation problems. Five such experimental installations were in newly constructed residences during the end of 1948 under the sponsorship of the electric utility companies of the American Gas and Electric Company system. (HEATING AND VENTILATING, May 1949). In general, these packaged units heated and cooled the house satisfactorily, although the electric energy consumption was 20 to 30 per cent greater than was expected. During the first few months of operation, the systems experienced considerable difficulties with compressor belt breakage, 4-way valve failures, erratic defrosting operation, and loss of refrigerant charge. The belt difficulties were eliminated by using heavier duty belts and by changing to a larger diameter sheave to increase the arc of contact. A different material and seat design corrected the 4-way valve. A more sensitive switch and a 7-minute cycle solved the defrosting difficulties, and the loss of refrigerant was considerably reduced by silver soldering all piping joints in order to withstand the high operating pressure of the F-22 refrigerant.

Many similar field installations, made throughout the United States under the sponsorship of manufacturers, research organizations and electric utilities resulted in many advancements. In judging the progress of the heat pump, therefore, proper consideration should be given to the improvements which have been made in the operating cycle, to the advancements in the design and assembly of the equipment into a self-contained package, to the data acquired from the many explorations of the various heat sources, and to the many and reasonably successful efforts to improve the reliability and efficiency of the device. Each of these factors will be discussed in detail in order to more clearly show the extent of this progress.

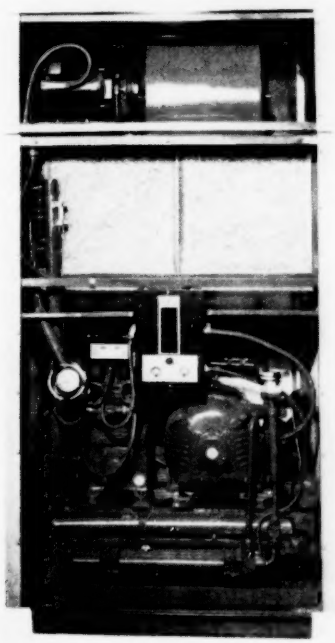


Fig. 2. Heat pump unit (American Coils Company, Newark, N. J.) uses water as the heat source - sink. Available with 2 to 10 hp compressor units.

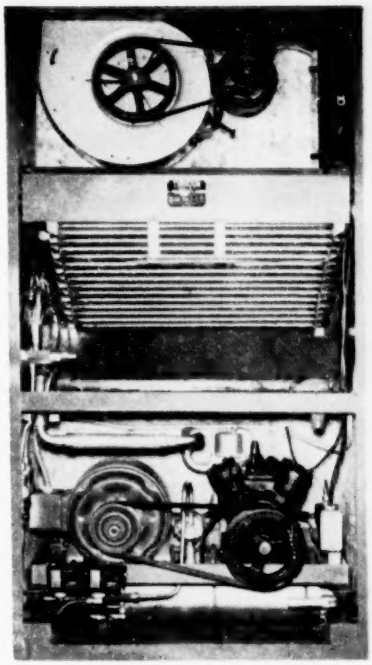


Fig. 3. Heat pump unit (Typhoon Prop-R-Temp Corp., Tampa, Fla.) uses water as the heat source - sink. Available with 2 to 20 hp compressor units.

Heat Pump Cycle

The flow diagram commonly used in today's heat pump is shown in Fig. 1. There has been no basic change in the flow arrangement during the past ten years. The equipment used in the cycle has been materially improved, however, to give a more dependable and practical installation. It is to be noted that, while open type compressor-motor combinations are now generally used, future plans of most manufacturers call for hermetically sealed units.

A 4-way valve is shown in Fig. 1 to change the direction of the refrigerant flow between the heat source-sink and the conditioner coil. Two 3-way valves, or a 3-way solenoid valve and a piston actuated director, can be used in place of the 4-way valve. The latter valve combination, shown at *A* of Fig. 1 as an optional method for changing the direction of the refrigerant flow, was recently developed for use in the $^3/_4$ and 1 hp window type heat pump conditioner. One manufacturer is using capillary tubes to replace the expansion valves, check valves and liquid receiver as shown at *B* of Fig. 1. When capillary tubes are used, however, an accumulator must be added in the suction line and placed just ahead of the compressor.

There are also many systems operating in which the refrigerant flow is fixed and the direction of the heat transfer medium to and from the heat source is changed to obtain heating and cooling. This cycle is particularly attractive for commercial installations where individual conditioner units are employed.

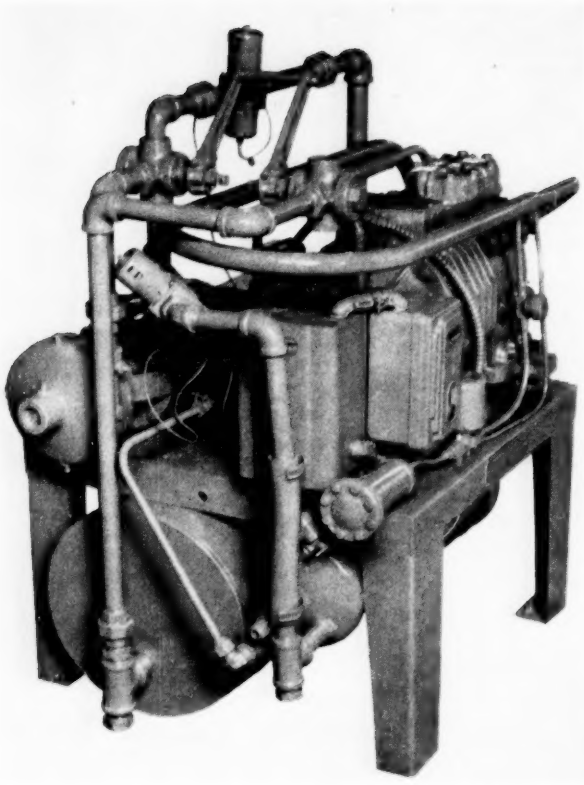


Fig. 4. Heat pump unit (Acme Industries, Inc., Jackson, Mich.) uses water or the earth as the heat source. Available with 2 to 15 hp compressor units.

The various possible flow arrangements, as well as the broad selection and flexible arrangement of component parts, make the heat pump ideally suited to a self-contained package device.

Units for Residential and Commercial Use

At least six manufacturers are now making self-contained packaged units in sizes ranging from 2 to 20 hp, and all of the leading air conditioning manufacturers can furnish suitable equipment for use in custom-built systems. The packaged units were primarily designed for residential and small commercial installations, but the use of multiple units is finding increasing favor in the larger installations.

The latest packaged units to appear on the market are the ¾ and 1 hp window conditioners for heating and cooling. These units use the outdoor air as heat source and sink. From all appearances, these smaller units should be very popular for furnishing both the heating and cooling requirements in areas where the outdoor temperature seldom drops below 32F. In the colder locations such units will be primarily selected for cooling a particular space, but can also be used to heat the space in late summer and early fall when the central system is not operating.

Four of the available packaged units in the 2 to 20 hp range use water as the heat source-sink and two use air. Having packaged units readily available is materially different from conditions existing ten years ago when all installations had to be custom-built, and in most cases conventional equipment had to be adapted to the design. In the early systems some of the accessory equipment, such as the refrigerant reversing valves, was not readily available which added design complications. The systems, however, usually could be made to perform satisfactorily but were dependent to a large degree on the experience and knowledge of the design engineer.

Some of the typical packaged heat pump conditioners, now available, are shown in Figs. 2 through 7. Water is the heat source and sink for the units shown in Figs. 2, 3 and 4, and air for those in Figs. 5, 6 and 7. The units in Figs. 2 and 3 use a 4-way valve to change the direction of the refrigerant for heating and cooling. The unit in Fig. 4 is somewhat different in that it has a fixed refrigerant circuit and two 4-way valves in the water circuit to change the cycle between heating and cooling.

Two 3-way valves change the direction of the refrigerant flow in the air-to-air heat pump shown in Fig. 5 and one 4-way valve serves the same purpose in the Fig. 6 unit. A capillary tube is also employed in this unit to regulate the refrigerant flow from the high to the low side as illustrated in *B* of Fig. 1. The window heat pump unit, Fig. 7, uses a manual 4-way valve to change the direction of the refrigerant flow but designs, scheduled to appear on the market shortly, substitute an automatic 3-way solenoid valve with a piston actuated director, similar to that shown at *A* of Fig. 1. Fig. 8 shows the heating capacity of one of the ¾ hp window conditioners at various outdoor temperatures. The heating capacity obtainable with a strip heater, which is equivalent to the wattage input of the compressor motor during the cooling cycle, is indicated on this figure at 4,400 Btu per hour. The heating output of the heat pump considerably exceeds this figure at outdoor temperatures of 30 to 70F.

Domestic Water Service Heaters

It is believed by many that the heat pump water heater has equal, if not greater, potentialities for general market acceptance than the air conditioner unit, at least for the immediate future. The water heater is readily adaptable

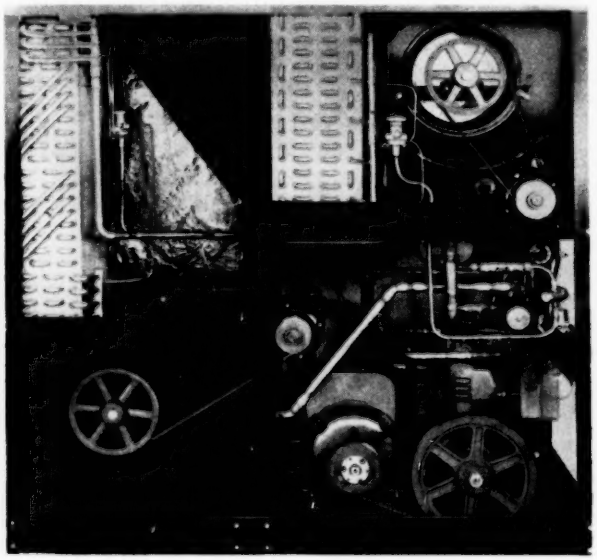


Fig. 5. Heat pump unit (General Electric Company, Bloomfield, N. J.) uses air as the heat source-sink. Available with 3 and 5 hp compressor units.

to a self-contained packaged device for quantity production manufacture. The cooling and dehumidifying effect produced by the evaporator can be used to reduce the temperature and humidity in a space, thereby obtaining triple duty of (1) cooling the space, (2) dehumidifying the space, and (3) heating the domestic water.

Production heat pump water heaters are not yet available, but several manufacturers have developmental units on field test. One such model, of which about 75 are now operating in the field, is shown in Figs. 9 and 10. This unit has a ½ hp (nominal) compressor and a heat recovery rate of about 7,300 to 7,800 Btu per hour when supplying 150 to 135F water, respectively. Performance factors of the field unit (including standby losses) range from 2.4 to 2.8, depending on the temperature and amount of water used.

The latest field test units have an independent cooling thermostat so that cooling and dehumidification can also be obtained independently of the domestic water heating requirements.

Heat Sources

At the present time there are about 50 per cent more heat pump installations using water as the heat source-sink than using air, although air systems have been increasing during the past few years. In all probability, this trend will continue, particularly in the warmer climates. In contrast, relatively few systems employ the earth as a heat source and sink.

Earth as a heat source and sink offers interesting possibilities, particularly for the residential heat pump, even though relatively few such installations have been made to date. There has been an almost unbelievable amount of laboratory and field investigation, but as yet no dependable relationship between the influencing design factors has been developed, and research must be continued. Some idea of the amount of embedded surface required for a given installation can be obtained from a study of results of all of the completed projects. A recent tabulation of such results indicates that, depending on existing conditions, from 200 to 400 feet of ¾ to 1½-inch piping is needed per nominal compressor horsepower. The average refrigerant temperature of such systems, during the heating cycle, is 20F and the reported seasonal performance factor varies from 2 to 3½. A few residential installations using the earth as the heat source-sink are being made at the present time. This type of installation, however, has lost some of its appeal due to the relatively high installation cost caused by the difficulty of embedding the surface, and to the large amount of piping needed for a typical size residence.

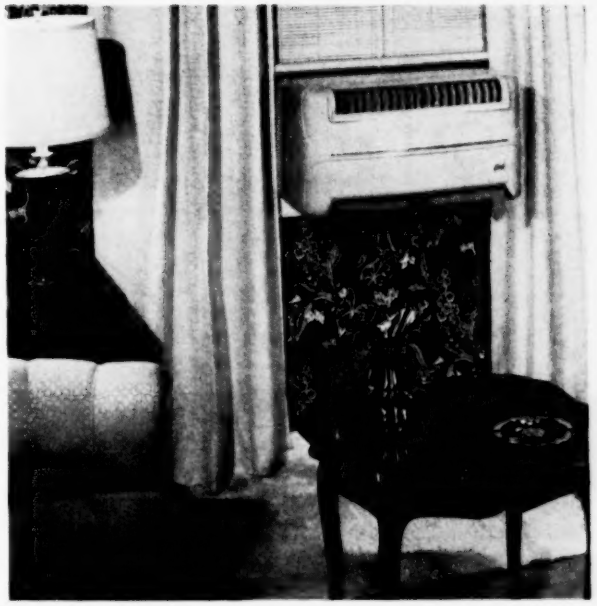


Fig. 7. Packaged window model heat pump unit (York Corp., York, Pa.) uses air as the heat source-sink. Available in ¾ and 1 hp.

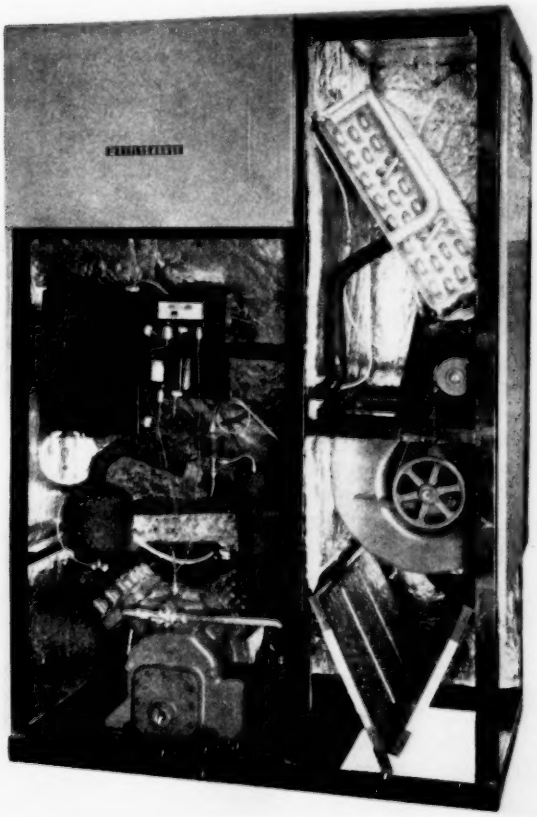


Fig. 6. Heat pump unit (Westinghouse Electric Corp., Hyde Park, Mass.) uses air as the heat source-sink. Available with 3 and 5 hp compressor units.

Well water is a most attractive heat source from the standpoint of obtaining maximum operating efficiency. Unfortunately, it is becoming increasingly difficult to obtain water which requires neither extensive treatment nor the use of special expensive metals. In many cases, disposal of the water may also be a problem, since many cities now have a sewer tax on such usage. Cost of well drilling and pump maintenance further detracts from the use of well water in many areas.

Air with a supplementary heat source, when necessary, is believed destined to become ultimately the most practical and attractive heat source and sink for the heat pump for most areas in the United States. Frost accumulation on the heat absorbing coil at outdoor temperatures of approximately 32F or lower have caused some operating difficulties, mainly because the automatic defrosting mechanism did not function as intended. Considerable field data have been accumulated on the frosting and de-

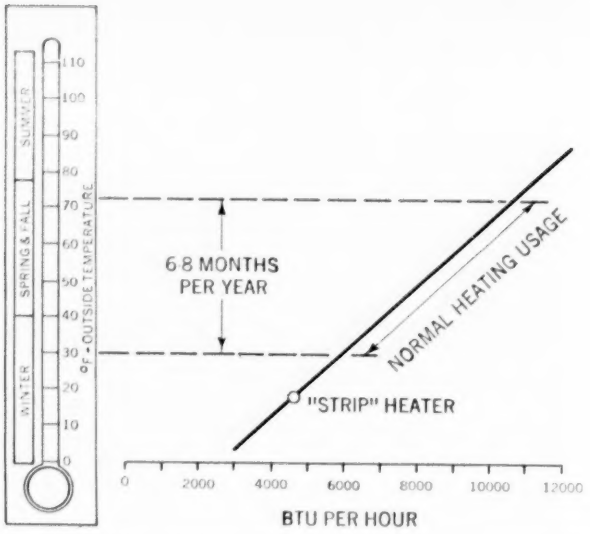


Fig. 8. Heating capacity at various outdoor temperatures for the ¾ hp window model unit shown in Fig. 7.

frosting of coils in various geographic areas of the country during the past few years, and it is hoped that this difficulty will soon be practically eliminated. Another fundamental design difficulty of air units is the fact that the heat source temperature is at a minimum during periods of maximum heating requirements. Auxiliary solar heat and/or thermal storage may offer a solution to this problem, but further research is needed before practical designs can be expected. Supplemental electric resistance heating, although it has often been considered, is not an acceptable solution, at least from the viewpoint of the electric supply system.

Installations

As of January 1, 1953 there are records of 1,134 heat pump installations in 45 of the 48 states as shown by Table 1. Undoubtedly, there are many more installations operating which are not included in this list. Of the residential systems in this table, supplementary heating is used by 68 air installations, 15 water installations and one ground installation; of commercial installations, supplementary heat is used by 25 air and 5 water installations. It can be noted from the list that the known installations in the United States are fairly evenly divided between residential and commercial. Such a small number of installations, after 18 years of effort is, in one sense, disappointing. But, as already pointed out, technical progress has been encouraging, particularly during the past few years.

Complete operating data have been obtained on field developmental units by several of the manufacturers, but relatively little similar data have been acquired on standard production models. It was for this reason that the electric utility companies of the American Gas and Electric systems have installed recording instruments on a number of installations in order to better observe their operation and performance.

An example of the field data obtained on the residential and commercial installations is given by Tables 2 and 3, and Figs. 11 and 12. Some of the important design data, such as building volume, calculated heat loss-heat gain, and the normal degree days experienced are also given in Tables 2 and 3 for residential and commercial installations, respectively. It can be noticed from Table 2 that the calculated heat loss for 70F temperature difference varies from 32.0 to 81.0 thousand Btu per hour (which is representative of today's construction) and the annual kilowatt-hours for heating and cooling range from 10,300 to 27,900 with an average of 18,700. The total kilowatt-hours (including heating and cooling, and all appliances) for the same residences range from 14,600 to 42,100 with an average of 26,700. Annual residential load factors of the heat pump only, given in column 10 of Table 2, vary from 22.4 to 48.0 with an average of 31.7.

The same design and operating data for ten typical commercial installations are given in Table 3. Building sizes range from 157,400 cu ft to 1,150,000 cu ft. The heat pump annual load factor for five of the installations varies from 35.6 to 57.8 with an average of 44.0. Annual load factors of the total load (including the heat pump and all other uses) vary from 33.3 to 50.4 with an average of 42.0.

In Table 3, the following 10 commercial buildings listed are:

(1) Roanoke Public Library, Roanoke, Va.
(2) Giles Memorial Hospital, Pearisburg, Va.
(3) Roanoke Health Center, Roanoke, Va.
(4) Inter-Mountain Telephone Company, Kingsport, Tenn.
(5) The Ohio Power Company, Canton, Ohio.
(6) Appalachian Electric Power Company, Roanoke, Va.
(7) The Ohio Power Company, Coshocton, Ohio.
(8) Kentucky & West Virginia Power Company, Pikesville, Ky.

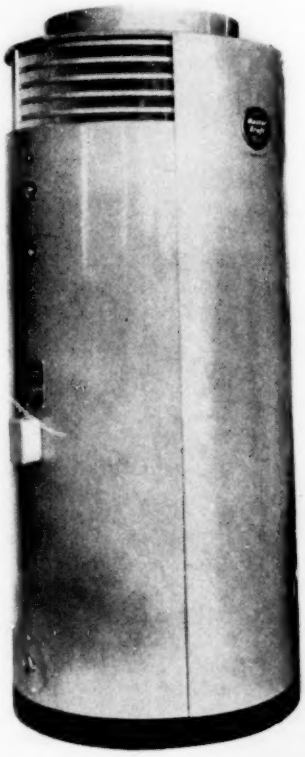
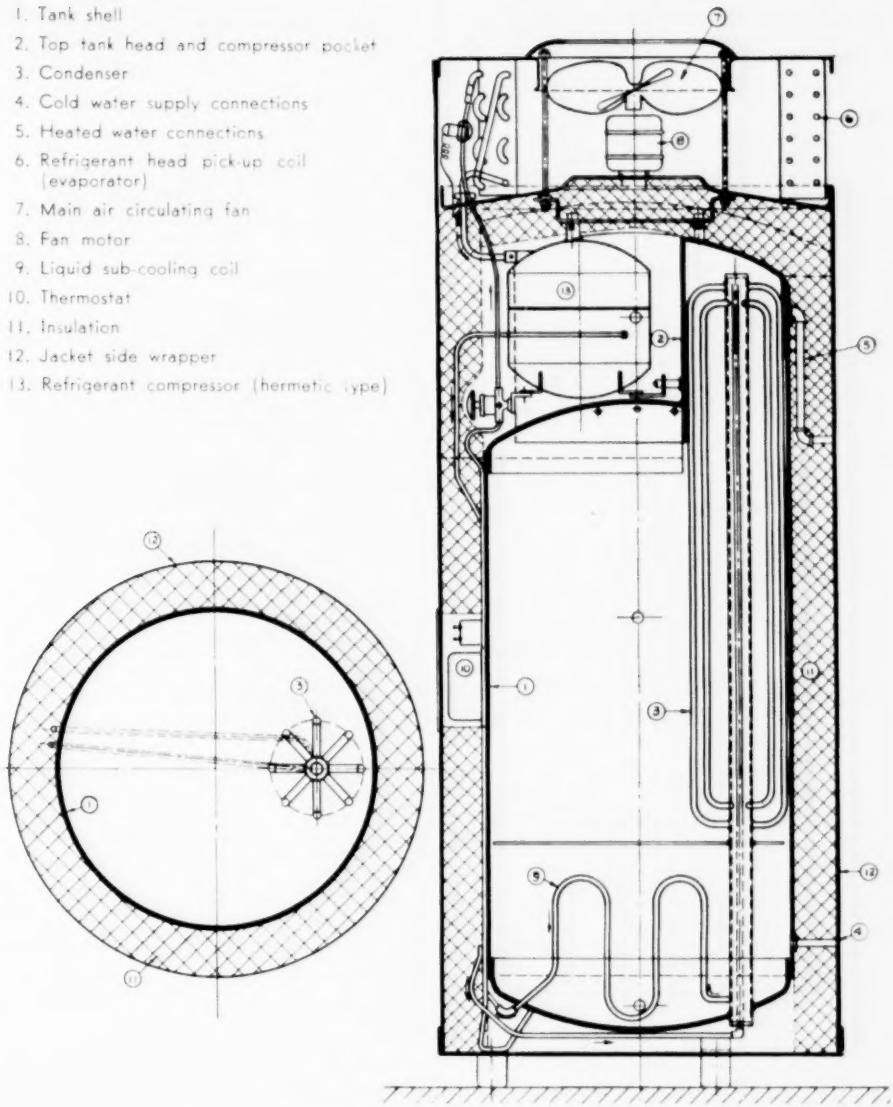


Fig. 9. Heat pump water heater for domestic water heating. Ambient air is used as the heat source. This ½ hp compressor pilot model (Harvey-Whipple, Inc., Springfield, Mass.) is for field testing.

Fig. 10. A sectional view of the Master Kraft packaged heat pump water heater showing some of the main parts.

1. Tank shell
2. Top tank head and compressor pocket
3. Condenser
4. Cold water supply connections
5. Heated water connections
6. Refrigerant head pick-up coil (evaporator)
7. Main air circulating fan
8. Fan motor
9. Liquid sub-cooling coil
10. Thermostat
11. Insulation
12. Jacket side wrapper
13. Refrigerant compressor (hermetic type)



(9) The Ohio Power Company, Portsmouth, Ohio.
(10) The Ohio Power Company, Steubenville, Ohio.

Annual kilowatt-hours of the residential and commercial installations of Tables 2 and 3 are plotted against their corresponding calculated heat loss in Figs. 11 and 12, respectively. The base of each vertical bar represents the heating kilowatt-hours and the top gives the heating and cooling kilowatt-hours. The photographs of some of the structures also appear on the charts in order to illustrate the type and kind of buildings which have been included in the tabulation. These photographs help one to visualize the type of structure.

TABLE 1. HEAT PUMP INSTALLATIONS

Heat Source	Residential	Commercial	Domestic Water Heaters
Water	347	252	
Air	165	242	80
Earth	40	8	
Total	552	502	

Based on installations for which authoritative data were received by the Joint AEIC-EEI Heat Pump Committee.

A definite relationship between calculated heat loss, kilowatt-hours, and degree days is rather difficult to obtain because of the many influencing factors, such as geographic location, heat storage effect of the structure, indoor temperature maintained, wind velocities, solar heating effect, and the living habits of the occupants. In spite of these variables, however, an analysis of these relatively few installations seems to indicate a rather loose relationship between the kilowatt-hours and the calculated heat loss. Perhaps as more installations are included, the trend will be more pronounced and minimum and maximum limits can be safely established.

The number of auxiliaries which are included as part of the heat pump system and the way they are controlled will also materially affect the kilowatt-hour consumption. For instance, the kilowatt-hours will be considerably greater than expected if the deepwell pump also supplies the domestic water for the residence at a pressure of 40-50 psig (which is the case of residence No. 2). The deepwell pump, in such an arrangement, should be metered separately to obtain its effect on the total heat

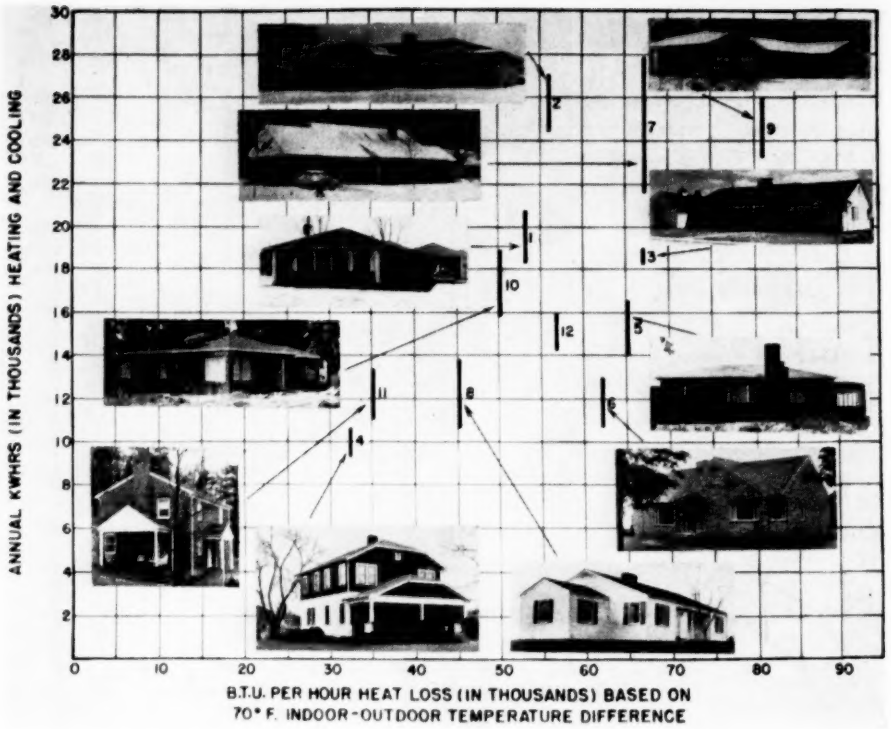

ANNUAL KWHRS (IN THOUSANDS) HEATING AND COOLING
B.T.U. PER HOUR HEAT LOSS (IN THOUSANDS) BASED ON 70° F. INDOOR-OUTDOOR TEMPERATURE DIFFERENCE

Fig. 11. Comparison of the annual heating and cooling kilowatt-hours and the calculated heat loss for 12 residential installations on the American Gas and Electric Company system. The top of the bar represents the total kwh for heating and cooling, while the bottom is for heating only. Photographs of residences are keyed to each installation.

pump electric load, and in all fairness, that part of its electric consumption allocable to domestic water should not be chargeable to the heating and cooling system. Also, the amount of time that the fan is operated for ventilation only will affect the total kilowatt-hours. This consumption might be considerable during the year as it has been found that ventilation and air circulation are frequently required in the tightly closed, well-insulated structures, during late spring and early fall when neither heating nor cooling is needed. This, however, cannot be divorced from the heat pump.

Evaluations of data, in Tables 2 and 3, and Figs. 11 and 12, have repeatedly shown that the operating costs of heat pumps are very reasonable. In most geographic areas they will be found to compare very favorably with installations consisting of fuel-fired heating boilers plus mechanical cooling. An important observation from the electric utilities' point of view is that the annual load

TABLE 2. FIELD DATA OBTAINED FROM RESIDENTIAL PUMP INSTALLATIONS

Residence	Volume, Cu Ft in Thousands	Heat Loss in Thousands Btu Hr 70F Temp Dif.	Heat Gain in Thousands Btu Hr	Heat Source and Heat Sink	KWM (in Thousands) for Year					Heat Pump Only		Nominal Degree Days
					Heat Pump			Other Uses	Grand Total	Maximum KW Demand	Annual Load Factor	
					Heating	Cooling	Total					
	1	2	3	4	5	6	6a	7	8	9	10	11
1	11.5	53.0	22.3	Air	18.2	2.6	20.8	8.6	29.4	6.6	36.0	6425
2	17.2	56.2	33.8	Water	24.6	3.0	27.6	14.5	42.1	9.0	35.0	6020
3	19.3	67.0	35.0	Water	18.2	1.0	19.2	11.5	30.7	6.6	33.0	5885
4	13.6	32.0	. . .	Water	9.3	1.0	10.3	4.3	14.6	5.0	23.5	5630
5	22.3	65.0	45.0	Water	14.0	2.6	16.6	7.9	24.5	6.6	29.0	5610
6	15.8	61.9	33.5	Water	10.8	2.2	13.0	4.7	17.7	6.6	22.4	5340
7	23.6	67.7	. . .	Water	21.4	6.5	27.9	9.6	37.5	6.6	48.0	4250
8	14.7	45.5	22.7	Air	10.4	3.1	13.5	10.8	24.3	6.9	23.0	4180
9	26.5	81.0	41.5	Water	23.2	2.0	26.1	7.8	33.9	7.3	41.0	4175
10	8.8	50.8	. . .	Air	15.6	3.4	19.0	4.8	23.8	6.8	32.0	3980
11	13.5	35.0	17.0	Air	10.6	2.7	13.3	3.3	16.6	5.0	30.0	3875
12	17.2	56.5	. . .	Water	14.0	2.2	16.2	8.5	24.7	6.6	28.0	3875
Average	17.0	56.0	31.4		15.9	2.8	18.7	8.0	26.7	6.6	31.7	4937

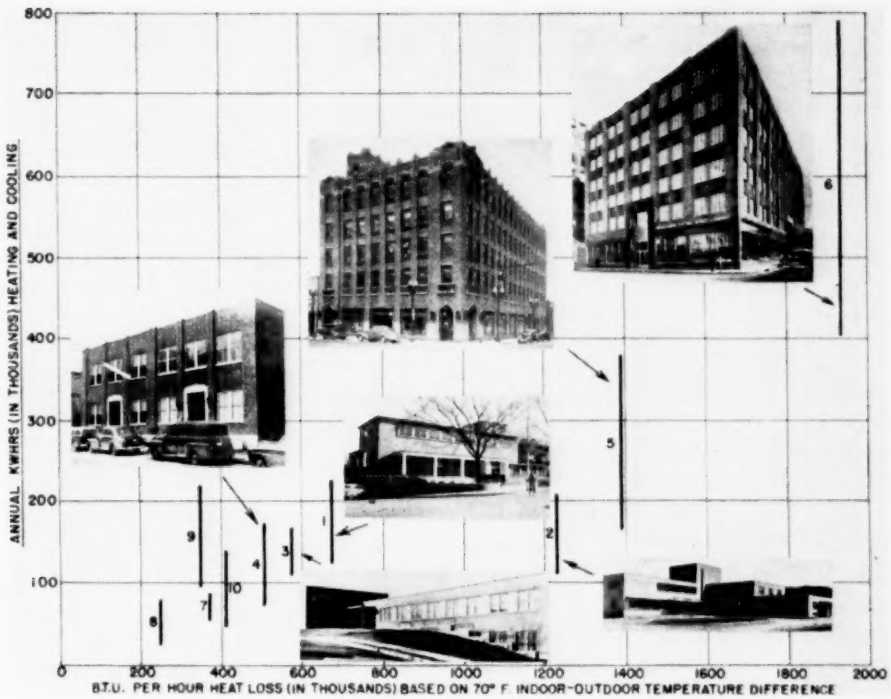


Fig. 12. Comparison of the annual heating and cooling kilowatt-hours and the calculated heat loss for 10 commercial installations on the American Gas and Electric Company system. The top of the bar represents the total kwh for heating and cooling, while the bottom is for heating only. Building photographs are keyed to each installation.

factor is improved by the heat pump in most instances and thus offers attractive possibilities for bettering the customer load characteristics.

Research: Present and Future

During the past nine years a number of research projects and investigations were initiated by colleges, universities, manufacturers, electric utilities, and similar organizations to explore various phases of the subject. Use of the earth as a heat source and heat sink received a considerable amount of attention. Some studies were made on the frosting and defrosting of a heat-absorbing surface when using air as the heat source. Limited investigations were made on the possibilities of supplemental and auxiliary heat sources, such as solar heat and thermal storage. The manufacturers, for the most part, have assembled pilot models and made extensive and thorough field tests to ascertain the suitability of the design. A brief discussion follows of some of the important research

TABLE 3. FIELD DATA OBTAINED FROM COMMERCIAL HEAT PUMP INSTALLATIONS

Buildings	Building Volume (1000 Cu Ft)	Heat Loss* 1000 Btu/Hr (Calc.)	Heat Gain 1000 Btu/Hr (Calc.)	Compressor HP	Heat Source and Heat Sink	KWH (in Thousands) For Year				Maximum KW Demand		Annual** Load Factor	
						Heating	Cooling	Lighting and Misc.	Total	Horse Power	Total	Heat Pump	Total Load
	1	2	3	4	5	6	7	8	9	10	11	12	13
1	392	675	660	2-40	Air	126.3	101.2	293.0	503.7	54.8	111.6	43.7	51.3
2	320	1220	665	2-30	Air	109.5	60.6	98.6	268.4	88.8	....	....	34.0
				2-15	Water								
3	173.5	568	477	2-25	Air	109.2	99.0	112.0	337.3	94.8	152.0	35.6	33.3
4	209.8	507	443.6	and		75.1	96.4	191.5	363.0	45.0	82.1	43.5	50.4
				1-20	Air								
				2-25									
5	510	1387	1019	and	Well	165.2	215.4	657.6	1038.2	74.9	272	57.8	43.2
				1-20	Water								
6	1150	1935	2079	3-75	Air	404.3	385.5	856.3	1646.1	258.0	472.3	39.4	39.8
				1-15									
7	165.9	373.0	404.7	and	Water	57.6	29.7	143.8	231.1	.....	.....	....	....
				1-20									
8	157.4	243.0	313.0	1-20	Water	25.9	56.7	224.0	306.6	.....	.....	....	....
9	208.5	354.7	450.0	2-25	Air	98.2	142.0	227.6	467.8	.....	.....	....	....
10	200.6	406.3	432.0	2-20	Air	24.8	117.3	191.1	333.2	.....	.....	....	....

*Based on 70F indoor-outdoor temperature difference.
**Load factor based on maximum 30-minute integrated demand during the yearly period.

now under way, together with additional projects which must be continued on an accelerated basis, if full advantage is to be taken of the potential year-round air conditioning market now developing.

Earth as Heat Source and Heat Sink

A number of field investigations have been made to determine the most practical pipe diameter and spacing arrangement, the temperature variation around the embedded surfaces, the moisture migration characteristics, and the heat transfer rates. The main objective of all this research was to develop a dependable and workable method of designing an embedded surface with reasonable accuracy under all operating conditions. The required surface can be determined within rather wide limits by a correlation of all available test results, but no definite relationship between the various factors has yet been developed. Exploration of this heat source should be continued with more emphasis on the practical ways of installing piping in the ground.

Frosting and Defrosting of the Outdoor Coil When Using Air as the Heat Source

Considerably more data is needed on the relationship between the temperature, relative humidity and air velocity of the outdoor air in order to develop a more practical coil design. The possibilities for reducing the refrigerant-air temperature difference and means of defrosting the outdoor coil without causing discomfort of the occupants, also requires further investigation.

Capacity of Air Heat Source Units at Low Outdoor Temperatures

Practical methods are needed for offsetting the disadvantage of having the lowest heat source temperature when the heating requirements are the greatest. Increasing the compressor speed at the lower outdoor temperatures is one possibility, but it presents difficulties when hermetically sealed compressors are employed. This method of increasing the capacity would be satisfactory, however, if a practical solution could be found, because the compressor would only operative a relatively small percentage of the time at this extreme condition. Another possibility of overcoming the handicap would be to size the compressor to meet the design requirements and then to unload the compressor at the higher outdoor temperatures to prevent overloading the motor. A third possibility is thermal storage which is the next item discussed.

Storage

The use of storage, during the heating and cooling cycle, for supplementing daily output to meet peak demand has long been known and the advantages, from the standpoint of the electric supply system and of the customer, have often been cited. In addition to using the system to store up heat in mild weather to serve as a booster during cold periods, it is possible, by these means, to reduce the magnitude of the maximum load and to increase the load factor by employing equipment of smaller capacity operating for longer periods. The timing of the load can also be controlled with a storage system to better fit into the supply system's peak responsibility electric load curve. While water has been used as a storage medium for this purpose, its application is limited because the space usually available is not sufficient for the large tank required.

Interest in heat pump storage systems has, however, been greatly stimulated by the attractive possibilities offered by chemical storage employing the heat of fusion or of crystallization principle. Investigations are under way to find a suitable storage substance with a relatively high latent heat of fusion at a temperature of 100 to 120F. When such a substance becomes available, it will offer possibilities for reducing the storage tank volume to approximately one-fourth or one-fifth of that required with water as a storage medium.

A number of difficulties must be overcome before the full benefits of chemical storage can be realized in a practical manner. Suitable containers must be found which will be low in first cost but yet readily adaptable to the system. The salt state must be reversible, beween the liquid and solid phase, at a positive and dependable temperature within narrow limits.

Laboratory investigations have been made on the use of disodium phosphate dodekahydrate, employing various seed crystals to start the process of crystallization and thus prevent extreme under-cooling below the melting point of the salt. Several residential field installations have been operating during the past two heating seasons, each employing about 6,000 2⅛-inch x 2⅞-inch containers of disodium phosphate salts. It has been observed in these field installations that considerable subcooling sometimes occurs before crystallization takes place, indicating that the seed crystal is not fully effective. The results, however, are believed sufficiently encouraging to warrant continuing this research on a much larger scale, since a practical storage medium will materially improve the competitive position of the heat pump as well as that of solar heating.

Solar Energy as Primary and/or an Auxiliary Heat Source

Solar energy, at sufficiently high temperature levels to permit direct utilization for comfort heating or for domestic hot water heating, has received a great deal of attention and a number of installations have been made. The minimum permissible collector temperature for direct utilization is usually about 120F. Since collector efficiency is inversely proportional to the temperature difference between the surface and the outdoor air, the efficiency of the collector operating at 120F would be materially lower than that obtained when using a temperature level of 50-60F or even lower. This lower temperature can be effectively utilized by a heat pump employing a heat absorbing coil for collecting the solar energy. At least one such installation has been in operation for two years. Additional research is needed to develop practical and efficient designs of solar heat collectors.

Improving Overall Coefficient of Performance and Performance Factor

The primary objective of the heat pump manufacturers and other interesting groups, at the present time, is to make available a practical, dependable and trouble-free device which will provide satisfactory year-round comfort. Undoubtedly, because of the limitations of present-day equipment, some compromises in efficiency have been made to accomplish this aim more expeditiously. In any

long range program, however, efforts must be made to obtain efficiencies closer to the theoretical maximum if the heat pump is to assume its proper place in the year-round air conditioning field.

As mentioned previously, one possibility for better efficiency is to improve the design of the heat transfer surface in order to reduce the refrigerant-heat source temperature differential. Ways and means must be found for providing capacity modulation so that the average performance factor will not be decreased when the equipment is sized to meet the design requirements. Also, it would be highly desirable, when air is the heat source, to reduce the air flow over the outdoor coil at the higher temperatures with a corresponding reduction in fan horsepower, to obtain a considerably higher season performance factor. Improved compressor and motor efficiencies are other possibilities for obtaining higher performance factors. Perhaps a new refrigerant may be a practical solution to some of the objectives.

There is, of course, a practical limit to the development of these suggestions. Improvements are possible, however, and any advancements in equipment design, efficiency and operation will materially enhance the prospects of the heat pump.

Low Temperature Distribution Systems for Residences

For maximum coefficient of performance during the heating cycle, it is necessary for the compressor to operate at relatively high suction pressures and at low condensing pressures. This means obtaining as high a suction pressure as is possible with the available heat source and using the lowest permissible delivery temperature to the conditioned space.

The minimum permissible delivery temperature to the conditioned space, when using air as the medium, depends to a considerable extent on the circulation rate which can be used without causing objectionable drafts. There has been a considerable number of improvements during the past few years in the design of the outlets for an air distribution system which permit higher discharge velocities and circulation rates, but considerably more improvement is needed in order to have a fully practical and satisfactory system, particularly in the residential field. Some form of radiant heating and cooling panel may be the ultimate answer, if means can be found to prevent condensation on the panel surface during the cooling cycle.

Closely connected to the proper distribution system is the reduction of the heat loss of the structure to a minimum practical value by use of insulation, double windows, and other heat saving devices. Less heat loss per unit volume permits smaller air quantities and, consequently, it is usually possible to use lower supply temperatures without adversely affecting the comfort of the occupants.

Some laboratory investigations are being devoted to this phase of the subject, but the tempo and scope of the studies and investigations must be considerably raised and expanded in order to obtain any worth while results in the foreseeable future.

Noise Prevention for Piping Systems

Both piping engineers and heating engineers have been troubled by the generation and transmission of noise in piping and heating systems. While this has been a vexing problem for some time, it is more acute at present because of the greater interest in noise and how one can reduce noise level, and also due to the number of functions in an industry that must operate at a low noise rating.

W. L. Rogers, assistant professor of mechanical engineering, Northwestern University, Evanston, Ill., has made a study of this subject upon which he based a paper Experimental Approaches in the Study of Noise and Noise Transmission in Water Piping Systems that was presented before the semi-annual meeting of The American Society of Heating and Ventilating Engineers that was held in Denver, Colo., June 29 to July 1, 1953.

The author stated that for many years there had been a lack of knowledge concerning the generation and transmission of noise in water piping and heating systems, as these are related to water velocity, water temperature, pressure, pipe size, design configuration and pump vibration. Due to the need for more information on the subject, a project was sponsored by the society in cooperation with Northwestern University to study the problems involved. A research project, therefore, was inaugurated to study the relationships of the variables involved and to discover and evaluate methods by which noise levels could be reduced.

The first step involved the design and construction of the experimental equipment in which the variables could be controlled. It was planned to investigate the noise characteristics of straight runs of pipe, of pipe fittings, and finally to allow for the insertion of pumps so that their noises could be studied and superimposed on various piping arrangements.

The experimental work to date has been of a qualitative nature, according to Prof. Rogers, and mainly concerned with the preliminary testing.

Although quantitative information was not available at the time of this study, he presented the following possible quieting schemes:

(1) A given total pressure drop should produce less noise if graduated over a series of valves instead of being taken across a single valve.

(2) Liquid-borne vibrations can be effectively reduced by allowing the liquid to travel through soft rubber hose.

(3) Another possibility for reduction of transmitted noise is offered by suitable piping arrangements which might introduce interference effects.

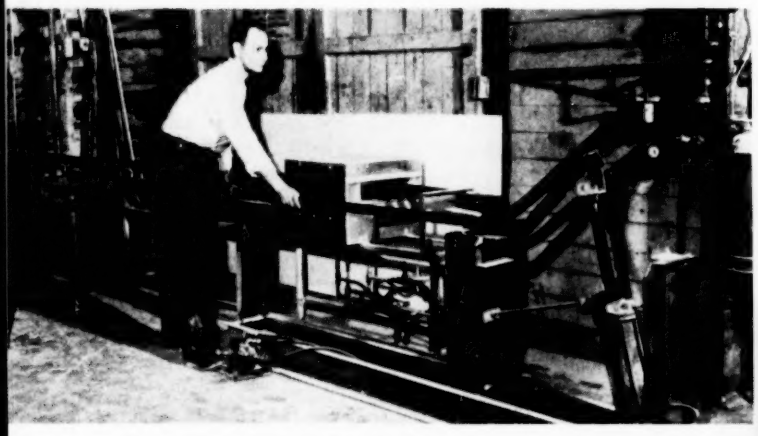
(4) To reduce structural-borne vibrations, there are the possibilities of isolating the piping from noise (vibration) sources by suitable couplings, and of introducing damping.

(5) Breaking the solid connections by using flexible supports to decouple pipe vibration from the building structure can sometimes prove helpful.

A water tank at Shell Pipe Line pumping station provides striking similarity to golf ball and tee.

Cleaning of Trion electronic air cleaner situated 20 feet above the floor is accomplished at a Mennen plant near Morristown, N. J., by a hand switch which activates the cleaning mechanism. When switch is thrown, aluminum collecting plates are spray washed.

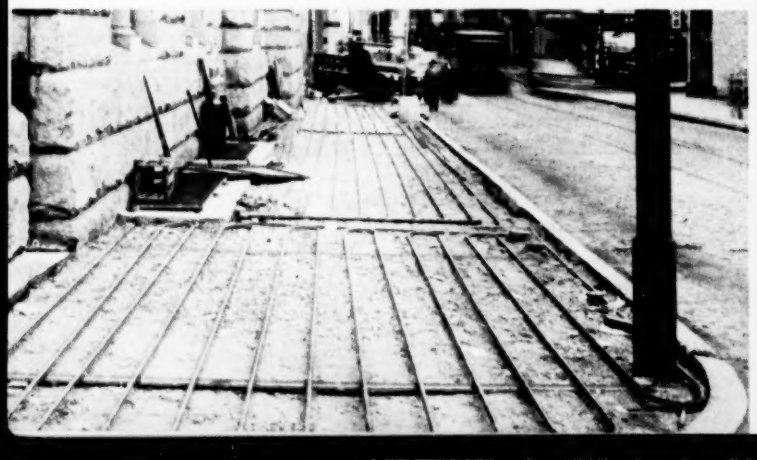
Picture Paragraphs



(Left) Glass lined steel pipe is bent to specifications at Barrows Porcelain Enamel Co., Cincinnati, by a new air-operated machine. Glass coated pipe is spot heated to 1500 F in small furnace shown in background.

(Below) Even nuts and bolts which hold this pressure leaf filter frame together are made from vinyl plastic. Filter is designed to separate heavy sludge from hot sulphuric acid.

(Below) A snow melting system was installed by Keystone Shipping Co., Philadelphia, when sidewalk required replacing. Wrought iron pipe heating coil is served by a heat exchanger using steam from the company's boiler.



Air Conditioning, Refrigeration, and Heating and Ventilating

Courses Offered by Colleges

NATHAN N. WOLPERT
Associate Editor, Heating and Ventilating

A tabulation (concluded from the previous issue) of courses in air conditioning, refrigeration, heating and ventilating, given by engineering colleges and institutes as part of the requirements for a degree or graduate study.

ENGINEERING COURSES AVAILABLE IN AIR CONDITIONING, REFRIGERATION, HEATING AND VENTILATING

Location	School	Course	Term Offered	Credit Hours	Prerequisites	Comments
MICHIGAN (continued)						
East Lansing	Michigan State College	Refrigeration	3Q	3		Service course
		Refrig. I and II	2-3Q	6	Thermodynamics	
		Refrigeration			Refrig. I & II	Graduate credit
		Heating and Vent.	2Q	4	Thermodynamics	
		Industrial Heating and Ventilation	3Q	4		
		Residence Heating	3Q	4		Wood Utilization major
		Heating and A.C.	1-2-3Q			Graduate credit
Houghton	Mich. College of Mining and Eng.	Heat., Vent., and A.C.	2-3Q	8	Thermodynamics	Senior elective
		Refrigeration	3Q	4	Thermodynamics	
MINNESOTA						
Minneapolis	University of Minnesota	Heat., Vent., and A.C.	1-2-3Q	3Q	Thermodynamics	Required of all M.E.
		Heat., Vent., and A.C.	3Q	3	Previous course	Elective
		Heat., Vent., and A.C. Design	1-2-3Q	3Q	Heating, Ventilation and A.C.	Elective
		Indust. A.C. and Exhaust Systems	1Q	3	Heating, Ventilation and A.C.	Elective
		Heating and Vent. Laboratory	1-2-3Q	2Q	Heating, Ventilation and A.C.	Elective
		Refrigeration	1-2-3Q	3Q	Thermodynamics	Required
		Advanced Refrig.	3Q	3	Refrigeration	Elective
		Refrigeration Design	3Q	3	Refrigeration	Elective
		Refrigeration Lab.	1-2-3Q	2Q	Refrigeration	Elective
		Advanced A.C.	1Q	3	Heating, Ventilation and A.C.	Graduate course
		Adv. Vent. and Air Distribution	2Q	3	Advanced A.C.	Graduate course
		Applied Heat., Vent., and A.C.	3Q	3	Advanced Vent. and Air Distribution	Graduate course
		Theoretical Refrig.	1Q	3	Refrigeration	Graduate course
		Applied Refrig.	2Q	3	Refrigeration	Graduate course
		Reverse Applications of Refrigeration	3Q	3	Refrigeration	Graduate course
MISSOURI						
Columbia	University of Missouri	Heating and A.C.	2	3	Heat Transmission	Senior elective
		Refrigeration Systems	1	3	Heat Transmission	Senior elective
		Psychrometry		2	Heat Transmission	Graduate course
		Industrial A.C.		3	Heating and A.C.	Graduate course
		Refrigeration		3	Refrig. Systems	Graduate course
		Refrigeration Plants		3	Refrigeration	Graduate course
St. Louis	Washington University	Air Conditioning		4		Senior requirement
		Air Conditioning				Evening course
MONTANA						
Bozeman	Montana State College	Heating and A.C.	3Q	3	Junior standing	Senior and graduate elective
		Refrigeration	1Q	3	Thermodynamics	Senior elective
		Radiant Heating	1Q	3	Heating and A.C.	Senior and graduate elective

Location	School	Course	Term Offered	Credit Hours	Prerequisites	Comments
NEBRASKA						
Lincoln	University of Nebraska	Mech. Equip. of Bldgs.		5		For Arch. Eng.
		A.C. and Refrigeration		3	Thermodynamics	Senior elective
NEW HAMPSHIRE						
Durham	University of New Hampshire	Heating and A.C.	1	2	Thermodynamics	Required of bldg. and construction engrs.
		Heating and A.C.	2	3	Hotel Administration	Hotel Admin. students
NEW JERSEY						
Hoboken	Stevens Institute of Technology	Refrigeration			These courese for 1954-55	Senior elective
		Air Conditioning				Graduate course
New Brunswick	Rutgers University	Fuels and Combustion	1	3	Heat Power	Senior course
		Heat Transfer	1	3	Heat Power	Senior course
		Refrigeration and A.C.	2	3	Heat Power	Senior course
		Refrigeration	1	3	Heat Power	Graduate course
		Air Conditioning	1	3	Heat Power	Graduate course
Princeton	Princeton University	Heat., Vent., and A.C.	2	3	Heat Power Eng.	Lecture and drafting
NEW MEXICO						
Albuquerque	University of New Mexico	Mech. Equip. of Bldgs.	1	4		Requir. for Arch. Eng. Elective for Ind. Arts
		Refrigeration	1	3	Thermodynamics	Elective
		Air Conditioning	2	3	Thermodynamics	Elective
		Adv. Heat. and A.C.		3		Graduate elective
State College	N. M. College of Agric. and Mech. Arts	Air Conditioning	1 or 2	3		Senior elective
		Refrigeration	1 or 2	3	Thermodynamics	Senior elective
NEW YORK						
Brooklyn	Polytechnic Inst. of Brooklyn	A.C. and Refrigeration	1	2	Thermodynamics	Day and evening course
		A.C. and Refrig., and Laboratory	2	2	A.C. and Refrig.	Day and evening course
Ithaca	Cornell University	Refrigeration and A.C.		3	Heat Power Eng.	Required for BME; elective for others
		Advanced A.C.		3		Graduate course
New York	College of the City of New York	Heat., Vent., A.C., and Refrigeration	1 or 2	3	Heat Transfer	M.E. requirement
		Heating and Vent.				Evening course
		Air Conditioning				Evening course
New York	Columbia University	Equip. Applications	2	4		Graduate course
		Air Conditioning I	2	3		Graduate course, evening
		Air Conditioning II	2	3		
		Refrigeration I	2	3		
		Refrigeration II	2	3		
New York	New York University	Heating, A.C. and Refrigeration	2	4	Thermodynamics	Day and evening
		Heat Pump	1	3	Thermodynamics	Grad. course, evening
		Air Conditioning	2		Thermodynamics	Grad. course, evening
		Heating and Vent.	2		Math. and Physics	Evening
		Air Conditioning	2		Heating and Vent.	Evening
		Refrigeration	2		Math. and Physics	Evening
New York	The Cooper Union	A.C. and Refrigeration	2	2	Thermo. and Heat Power	Day and evening course
Potsdam	Clarkson College of Technology	Applied Thermodynamics	1-2	8	Thermodynamics	Includes a.c., heating, vent. and refrig.
Rochester	The University of Rochester	A.C. and Refrigeration	1	3	Thermodynamics	Seniors and graduates. At times an extension course
Syracuse	Syracuse University	Mechanical Refrig.	1	3	Thermodynamics	Senior requirement*
		Air Conditioning	1	4	Thermo.; Heat Trans.	Senior requirement*
		Advanced Heating and Ventilation		3	Heat Transfer and Air Conditioning	Graduate course
Troy	Rensselaer Polytechnic Inst.	Heating and Vent.		2		U. S. Navy students
		Refrigeration		4		Senior elective
		Industrial A.C.		4		Senior elective
		Heating and A.C.		3		Graduate elective
NORTH CAROLINA						
Durham	Duke University	Heat., A.C., and Refrigeration	1-2	6	Thermo.; Heat Transfer, Fluid Mech.	Senior course
		Senior Laboratory				Covers above course
Raleigh	North Carolina State College	Heating and A.C.	1-2-3Q	9	Thermodynamics	Required of all students in Heating and A.C.
		Refrigeration	1-2Q	6	Thermodynamics	
		Heat. and A.C. Design	1-2-3Q	9	Concurrent with Heat. and A.C.	
		Heat. and A.C. Lab.	1-2-3Q	3		
		El. of Heat. and A.C.	3Q	3		3rd yr. arch. students
		Heating and A.C.	1Q	3	Thermodynamics	
		Refrigeration	2Q	3	Thermodynamics	Advanced undergrad. and grad. elective

*Starting in the fall of 1954, undergraduate work to be confined to one 3-credit hour course.

Location	School	Course	Term Offered	Credit Hours	Prerequisites	Comments
NORTH DAKOTA						
Fargo	North Dakota Agricultural College	Refrig. A.C.; Heat Power	2	4	Thermodynamics	Junior EE and IE&M
		Refrigeration	2	3	Thermodynamics	Junior M.E.
		Heating and A.C.	2	6	Thermodynamics	Senior M.E.
Grand Forks	University of North Dakota	Heating and A.C.		3	Thermodynamics	
		Refrigeration	2	3	Heating and A.C.	
OHIO						
Ada	Ohio Northern University	Refrigeration	1Q	3	Thermodynamics	
		Heating and Vent.	2Q	4	Thermodynamics	
Akron	The University of Akron	Heating and A.C.	2	3	Thermodynamics	Senior course
Athens	Ohio University	A.C. and Refrigeration	1	3	Thermodynamics	Senior year for M.E. Industrial optional
Cleveland	Case Institute of Technology	Refrigeration	1		} Fluid Mech.	Junior elective
		Heat., Vent., and A.C.	2		} Heat Transfer	Senior elective
Cleveland	Fenn College	Heating, Ventilating and Refrigeration		4Q	Thermodynamics	Day and evening. Required for Heat Power option
Columbus	The Ohio State University	Heat., Vent., and A.C.	3Q	4		For 4th year Indust.
		Heat., Vent., and A.C.	2-3Q	4	Heat Transfer	For 4th year M.E.
		Refrigeration and A.C.	3Q	3		Elective
		Refrigeration	1Q	3	Heating, Vent. and A.C.	For 5th year students registered for A.C. and Refrigeration
		Air Conditioning	2Q	3		
		Heat., Vent., and A.C Design	3Q	5		
Dayton	University of Dayton	Heating and A.C.	1	6	Thermodynamics	
		Refrigeration	2	6	Thermodynamics	
Toledo	University of Toledo	Heating and A.C.	1	2	Physics	Senior year
		A.C. and Refrigeration		2	Heat. and A.C.	M.E. and Industrial elective
		Heating and A.C. Lab.		2	Heat. and A.C.	Elective
OKLAHOMA						
Norman	The University of Oklahoma	A.C. and Refrigeration	1-2	4	Thermodynamics	M.E. requirement
		Advanced A.C.	1	4	A.C. and Refrig.	Elective
		Advanced Refrig.	2	4	A.C. and Refrig.	Elective
Stillwater	Oklahoma A & M College	Heating and A.C.	1	3	Physics	Part of Senior Refrigeration option
		Refrigeration	1	3	Thermodynamics	
		Refrig. Plant Design	2	2	Refrigeration	
		Advanced Refrig.	1	3	Ref. Pl. Design	Graduate course
		Adv. Heat. and A.C	2	3	Ref.; Heat., A.C.	Graduate course
OREGON						
Corvallis	Oregon State College	Refrig. and Cold Stor.	3Q	3		Also given by corresp.
		Heating and A.C.	1-2Q	6		} Senior, Heat. and
		Refrigeration	2Q	3		} Vent. option
PENNSYLVANIA						
Bethlehem	Lehigh University	A.C. and Refrigeration	1	3	Thermodynamics	} Senior or graduate
		Air Conditioning	2	3	A.C. and Refrig.	} students
Philadelphia	Drexel Institute of Technology	Heating and A.C. and Lab.	3	3½		M.E. Seniors
		Refrigeration and Lab.		3½		Elective
Pittsburgh	Carnegie Inst. of Technology	Pumps, Compressors and Refrigeration	1-2	5		Required evenings for B.S. in M.E.
Pittsburgh	University of Pittsburgh	Refrigeration and A.C.		3	Thermodynamics	
		Air Condition. Theory		2	Thermodynamics	Evening grad. school
		Mod. Heat. and A.C.		2	A.C. Theory	Evening grad. school
State College	The Pennsylvania State College	Air Conditioning		3	} Thermodynamics	Senior year
		Refrigeration	1	3	} and Heat Power	Senior year
SOUTH CAROLINA						
Clemson	The Clemson Agricultural College	Heating and Vent.	1 or 2	2	Thermodynamics	
		H. and V. Design	1 or 2	1	Heating and Vent.	
		Air Conditioning	1 or 2	2	Thermodynamics	
		A.C. Design	1 or 2	1	Air Conditioning	
		Refrigeration	2	2	Thermodynamics	
TENNESSEE						
Knoxville	The University of Tennessee	Refrigeration and A.C.	1Q	3	Thermodynamics	Basic refrig. cycles
		Refrigeration and A.C.	2Q	3	Heat Transmission	Functional study
		Refrigeration and A.C.	3Q	3	1Q and 2Q parts	Design factors
Nashville	Vanderbilt University	Refrigeration	1Q	4	Thermodynamics	M.E. requirement
		Heat., Vent., and A.C	2Q	4	Thermodynamics	M.E. requirement
TEXAS						
Austin	University of Texas	Heating and A.C.	1	3	Physics; Appl. Math.	Required of senior and arch. students
		Heating and A.C.		3	Thermo.; Heat Eng.	Senior elective
		Refrigeration		3	} Thermodynamics	Senior elective
		Heating and A.C.		3	} and Heat Eng.	Graduate course
		Refrigeration		3		Graduate course
		A.C. and Refrig. Research			Grad. standing	Graduate thesis

Location	School	Course	Term Offered	Credit Hours	Prerequisites	Comments
TEXAS (continued)						
College Station	Agricultural and Mechanical College of Texas	Refrigeration		3	Thermodynamics	Senior elective
		Heat., Vent., and A.C.		3	Thermodynamics	Senior elective
		Advanced A.C.		4	Heat., Vent., A.C.	Graduate course
Dallas	Southern Methodist Univ.	A.C. and Refrigeration	1-2	4	Thermodynamics	Senior elective; 2 co-operative terms, 8 weeks each
Houston	The Rice Institute	Power Plants, Heating, Vent. and A.C.		10	Thermodynamics and Heat Eng.	For 5th year students
Kingsville	Texas College of Arts and Indust.	Air Conditioning		3	Thermodynamics and Heat Engines	
Lubbock	Texas Technological College	Heating, Ventilating and A.C.	1-2	6	Thermodynamics	Senior elective
UTAH						
Salt Lake City	University of Utah	Heating and A.C.	1	5	Thermodynamics	Includes some refrig.
		Advanced Refrig.		3	Heating and A.C.	
VERMONT						
Burlington	Univ. of Vermont	Air Conditioning	1	4	Thermodynamics	Senior elective
VIRGINIA						
Blacksburg	Virginia Polytechnic Institute	Heating and Vent.	1Q	3	Thermodynamics	Senior elective
		Air Conditioning	2-3Q	6	Thermodynamics	Senior elective
		Refrigeration	2Q	3	Thermodynamics	Senior elective
		Advanced A.C.	1-2-3Q	9	Air Conditioning	Graduate course
Charlottesville	University of Virginia	Refrigeration and A.C. and Laboratory	1	4½		
WASHINGTON						
Pullman	State College of Washington	Heating and Vent.	1	3	Physics	Arch. Eng. require.
		Refrigeration and A.C.	2	3	Thermodynamics	Senior elective
Seattle	University of Washington	Air Conditioning		3	Heat Power	
		Refrig. (inc. Lab.)		3	Thermodynamics	
		Air Conditioning		3	Grad. standing	
		Refrigeration		3	Grad. standing	
WEST VIRGINIA						
Morgantown	West Virginia University	Heat., Vent., and A.C.	1 or 2	3	Heat Engines	Elective
		Advanced Refrig.	1 or 2	3	Heat., Vent. and A.C.	Graduate elective
WISCONSIN						
Madison	University of Wisconsin	Refrigeration	2	3	Thermodynamics	Elective in Heating and Ventilating
		Heating and Vent.	1	3	Thermodynamics	
		Advanced Heating, Vent., and A.C.	2	3	Heating and Vent.	
		Heat. and Vent. Lab.	2	2	Heat Power Lab.	
Milwaukee	Marquette University	Heating and Vent.	1Q	3	Heat Engines	4th year
		Refrigeration	3Q	3	Heat Eng.; Thermo.	4th year
		Refrigeration Lab.		2	Mech. Eng. Lab. and Thermo.	Elective
WYOMING						
Laramie	The University of Wyoming	Heat., Vent., and A.C.		3	Heat Transmission	Elective
		Refrigeration		3	Thermodynamics	Elective
		Mech. Equip. of Bldgs.		5	Physics	M.E. and arch. students

Air Conditioning Combats Heat in Telephone Equipment

Air conditioning is being used by telephone companies to combat the problem of heat generated by communications equipment. This was explained in a paper, Heat Dissipation from Toll Transmission Equipment, by J. A. Coy, an engineer with Bell Telephone Laboratories, Inc., that was presented before a meeting of the American Institute of Electrical Engineers at Vancouver, B.C.

It was pointed out that although the equipment was being made smaller, more electronic tubes were being installed so that a new heat problem was created. Transistors are being used. These are tiny devices that, in some instances replace vacuum tubes. While they will reduce heat and space problems, they must be kept relatively cool—about 140F. The increased demand for toll service and automatic switching tends to increase the total amount of heat tha will be dissipated from the telephone equipment.

One of the recommended approaches to this problem is to partition off or enclose the heat-generating equipment so that it is in a separate enclosed room. Packaged air conditioning units can be used for full duty. Where the primary objective is the removal of heat generated by the equipment, unit conditions can be operated with only thermostatic control since humidity control is not necessary.

Mr. Coy said that a vivid illustration of the amount of heat generated by some communications equipment is the 120 N Carrier Terminals, which can easily be contained in a room 20 by 30 ft. This equipment will release 42 kw of energy. At present space is being reserved for as many as 300 terminals in one room.

Flow and Fan—
Principles of Moving Air through Ducts

C. HAROLD BERRY
Gordon McKay Professor of Mechanical Engineering, Harvard University

Part 9. Fan and System

Having observed the effects of fan diameter and speed, system resistance and gas density on fan performance in previous issues, the author continues his 12-part series with a comparison of similar fans and shows how to predict fan performance by test results.

A COMPARISON of the relations for the system with those developed for the fan will indicate complete consistency. To be sure, a change of size requires that all of the system dimensions (diameters and lengths) change in the same proportion, and this is not a common thing, as remarked previously.

But for the same fan and the same system it is evident that the relations agree. As the fan speed varies, Q varies as N and H as N^2. For the system, H_s varies as Q^2, which amounts to the same relationship.

If a different gas is handled, the fan (at the same speed) delivers the same Q but develops a pressure H proportional to the density ρ. For the same system, H_s is proportional to the density ρ for flow in the turbulent region, which is a common case.

If we express the system resistance in terms of the equivalent orifice, then we may apply the relations developed from equation (179) for changes of size, and we see that the resistance of the orifice changes with the orifice diameter in the same way that the pressure developed by the fan varies with fan diameter. Thus if the diameter of the equivalent orifice is held proportional to the fan diameter, complete consistency follows. We have already remarked that the diameter of the equivalent orifice is rarely computed (from equation 180), and accordingly its detailed study is perhaps unimportant, but it is at least interesting to note that if the concept were reduced to numerical terms, no contradictions would ensue.

Density Effects

The last paragraph merits further emphasis. If a system and fan are designed to handle a given volume Q cfm of a given gas, say air with $\rho = 0.075$ lb per cu ft, then if this same equipment is caused to handle gas with a different density, it will still deliver the same volume, Q cfm. This is on the assumption that the flow throughout the system is purely turbulent, i.e., there is neither laminar flow nor constant resistance in any part of the system.

Thus a fan and system (with turbulent flow) may be designed for any convenient value of the density. Usually 0.075 is used. Then it makes no difference in Q whether this system handles a gas of greater or less density. It may handle colder or hotter air. It may work at any barometric pressure, at sea level or at high altitude. The effect of humidity on atmospheric density need not be considered; Q will be the same regardless.

Not so for power, which will vary in proportion to the gas density. This is easily corrected in the final results. And of course the pressures will vary with the density, but usually the only object of the pressure is to move the gas, and if we get the desired Q, we do not commonly think further of the pressures.

All of this assumes that what we want is a stated volume of gas per unit time. In ventilation practice this is usually the case. But there are situations in which this short-cut will yield erroneous results. In a chemical process, such as the combustion of fuel, what we want is a stated number of pounds of oxygen per minute. So for such a case we must design the system so that under the least favorable conditions it will be capable of delivering the maximum desired mass of air. We must design for the lowest density (low barometric pressure and high temperature) and for the highest humidity. In short, we must design for extreme summer conditions.

A mixed system comprising turbulent flow, laminar flow, and constant resistance (positive or negative), or any two of them, can be designed only for the least favorable conditions under which the fan and system are expected to meet the specifications.

Reduction of Test Results

We have described the test of a fan to find its performance characteristics. A given fan of known impeller diameter is easy to find. But this is to be run at a stated speed and to handle gas of stated density. How can this be done? It cannot. The speed of the driver (usually an electric motor, preferably an electric cradle dynamometer) varies with the load (power) and with the supply voltage (and frequency if alternating current is used). The test is conducted with atmospheric air which must be taken at whatever density it chances to have at the time and place of the test.

The test comprises several runs (often ten) with different system resistance (different equivalent orifice) and there will usually be as many different speeds and densities, usually with small variations.

This presents no difficulty. Using the fan laws (the 1-2-3 law and the density law) for the sam fan, the actual results for each test run are used to compute what would have been the performance of the test fan if it had been run at the stated speed and handled gas of the stated density. The "corrected" values are plotted, giving a set of characteristic curves that truly represent performance at constant speed and constant density.

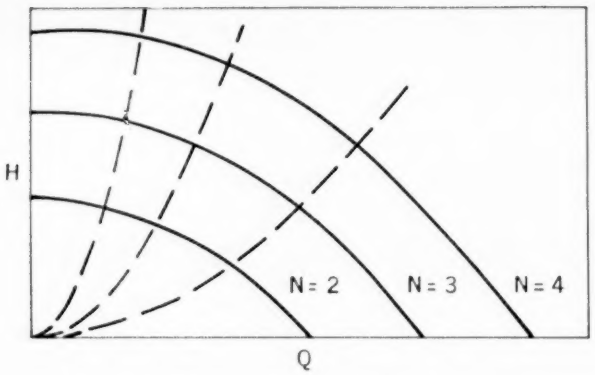


Fig. 53. Family of H-Q curves for a fan running at various speeds.

Corresponding Points

Consider a fan operating at various speeds, handling the same gas.

$$Q = kN; \qquad H = kN^2$$

For each speed there is a single *H-Q* curve. For a series of speeds there is a family of curves, such as those in Fig. 53.

Consider a point on the curve for N = 2 in Fig. 53. For the fan operating at the same equivalent orifice, where will be the corresponding point on the curve for N = 3 or N = 4? Easy answer: H is proportional to Q^2. We have already mentioned this in discussing the constant (h). Points for operation at the same equivalent orifice fall on a parabola with axis vertical and vertex at the origin. So upon the family of curves for the same fan at various speeds we may superimpose a family of parabolas for various equivalent orifices.

All of the intersections with one of these parabolas are referred to as corresponding points or even as the same point, e.g., we say that the fan is running at higher speed but at the same point, or the same point of rating, or at the corresponding point of rating, or at the same equivalent orifice. All sorts of phrases for the same idea.

When we consider two fans of different size it is not easy to state the relation of corresponding points. Perhaps the most obvious relationship is that, for any fan size or speed the H and Q at corresponding points are the same fraction of shut-off H and wide open Q, respectively, for all combinations of size, speed, and density.

Accuracy must always be considered. Accuracy of the fan test data, accuracy with which the fan laws or the dimensionless constants represent the behavior of actual fans, accuracy with which the design dimensions will be embodied in the structure of the fan and system, accuracy required in the final results set forth in the specifications, accuracy with which the results can be checked by test of the fan and system after they are operating.

This consideration of accuracy often indicates shortcuts that may be safe. Belabored multi-digit arithmetic is rarely justified in this field.

All of which is no excuse for sloppy work. Good engineering is good enough, but the result must be good enough. The alternative is exasperating and often costly failure.

Accuracy of Fan Laws

Many fans have been tested. Often similar fans of different size have been tested. Tests of the same fan have been made at different speeds. Various densities have prevailed. Thus we have a considerable body of data by which to test the accuracy of the fan laws, and the extent to which our dimensionless constants are constant.

The conclusion is that these laws and constancies are accurate within the limits of error of our best testing techniques. This is all we can know, and all we need. If we can predict the performance of any machine within the limits of error with which it is possible to check that performance, we need ask no more, at least for practical engineering work.

We may apply these relations for any gas density found in practice. We may apply them to a fan running at any speed, at least so far as present practice has gone. We may apply them to any fan size that is not too small. Somewhere between 2 and 3 feet wheel diameter lies the minimum size to which these relations may be applied without modifying corrections.

There is a tendency toward higher efficiency in larger sizes, and since our test data are usually taken from small fans, the actual efficiency of the large fan will perhaps be a little higher than the predicted value, an error that can readily be condoned. The improvement is small. For example, if a fan with wheel diameter of three feet shows an efficiency of 78%, a similar fan of nine-foot diameter, operating at the corresponding point, might be expected to show an efficiency of 80%. For very small fans of a series, some allowance may be made.

It should be remarked that these same relations should be applicable to centrifugal pumps, but that the losses in a pump are more severe than those in a fan. Gases are easy to handle, and great liberties may be taken with impunity. Water, with 800-fold density and 100-fold viscosity, must be treated more respectfully, and does not behave in so simple a fashion. Accordingly the centrifugal pump and water wheel engineer uses modified forms of the foregoing relations. Exponents differ from 2, 3, and 5, and correction factors are introduced. The influence of size on efficiency has been studied, especially for water wheels, and has been formulated in various empirical equations. It should be noted that equations involving fractional powers of D and V cannot be dimensionally consistent, and hence cannot be correct. The true situation is that the Reynolds number appears with some fractional exponent, and since this involves D and V, a cancelling process leaves a simpler-appearing equation with fractional powers of D and V. The Reynolds number, being itself dimensionless, may appear with any exponent without affecting the dimensional consistency of the equation.

Model Testing

From the theory of the flow of fluid through a rotating impeller the performance of a fan can be forecast, but not accurately. Departures of ten percent are not uncommon. The only way to secure accurate knowledge of the performance of any fluid-handling equipment is to build it and test it.

This may be difficult by reason of the size of the

equipment. It may be a fan with a wheel ten feet in diameter, requiring several hundred horsepower to drive it. The test equipment would be bulky and costly, and the operating cost of the test would be prohibitive. The author has tested a large fan when the cost of the test considerably exceeded the cost of the fan. Incidentally, this is not a fair comparison: the cost of a test should be compared with the cash value of the power that the fan will consume during its life; this power cost will usually far exceed the price of the fan, just as an automobile that is used heavily for a reasonable life will burn fuel aggregating well above the cost of the car.

This difficulty is overcome or averted by testing a small fan that is geometrically similar to the fan in question. The performance of the big fan is computed from the test results for the smaller fan, often called the model.

It sometimes happens that for an important job it is desired to build a fan of special design, to secure special results. If the fan is to be a big one, the procedure is to build a model of manageable size and test it. Then, by modifications of the model (suggested by theory or by special tests or by simple hunch) followed by further tests, an acceptable design is finally reached, and the full-sized machine is built.

This practice, common for pumps, is not common for fans, because the selling price of even a special fan will not ordinarily support so elaborate a program. A special fan is rarely more than a special size of an established design.

On the other hand, a fan manufacturer may decide to offer a series of fans of a new design. In that case he may be willing to spend much money in developing and testing a model to serve as the prototype of the series.

For important hydraulic power or pumping projects special designs are often worked up from extensive model tests. Performance records have been made in this way.

This resort to model testing is a confession of ignorance. Our knowledge of fluid flow is imperfect and our mathematical methods may be inadequate. In recent years notable advances have been made in the study of hydro- and aerodynamics and in the pertinent methods of mathematical analysis, so that today we can often do much better by theoretical study than by model testing with large savings in time and money. Striking illustrations could be cited from recent commercial developments. Theory pays handsome dividends.

Converting Fan Performance Data

We return to the practical task of the engineer. A manufacturer makes, among others, a fan denoted as Type SXW. He makes this fan in a series of sizes, each size defined by the wheel diameter, or by an arbitrary symbol (often a number proportional to the diameter). We have a set of characteristic curves in Fig. 54 determined by test of a Size 6 fan of this series. As stated on the curve sheet, D = 36 inches, N = 600 rpm, ρ = 0.075 lb per cu ft.

We wish to forecast the performance of a size 7 fan for D = 42 inches, N = 1150 rpm, ρ = 0.045 lb per cu ft.

The method is straightforward. For a given test Q we read H and P for the test fan, and then compute and plot the corresponding values for the size 7 fan. Thus point by point we develop the desired curves.

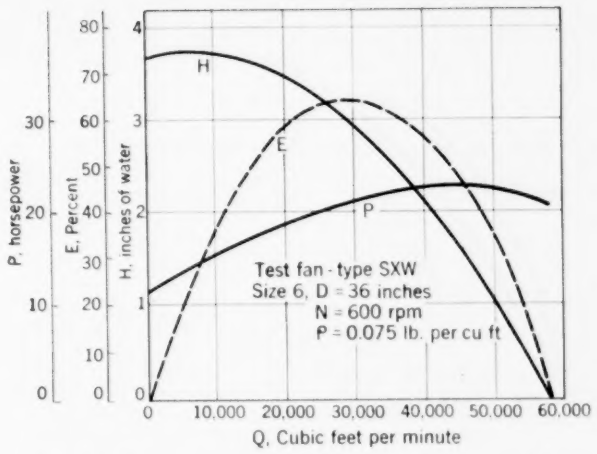


Fig. 54. Representative test curves of a hypothetical fan showing characteristics of a series of similar fans.

Two methods of computation will be presented. They are strictly identical, but appear in different dress.

First Method Using Dimensionless Constants

For ready reference, we repeat the four constants developed in Part 8:

$$(a)\ \frac{Q}{D^3 N} \qquad (b)\ \frac{H}{D^2 N^2 \rho} \qquad (c)\ \frac{P}{D^5 N^3 \rho} \qquad (d)\ \frac{QH}{P}$$

Using dimensionless constants (a), (b), and (c), we set up their equality for the two fans. We shall denote the test fan by subscript 0 and the desired fan by 1.

$$\frac{Q_1}{D_1^3 N_1} = \frac{Q_0}{D_0^3 N_0} \quad ; \quad Q_1 = Q_0 \left(\frac{D_1}{D_0}\right)^3 \left(\frac{N_1}{N_0}\right) \tag{202}$$

$$\frac{H_1}{D_1^2 N_1^2 \rho_1} = \frac{H_0}{D_0^2 N_0^2 \rho_0}$$

$$H_1 = H_0 \left(\frac{D_1}{D_0}\right)^2 \left(\frac{N_1}{N_0}\right)^2 \left(\frac{\rho_1}{\rho_0}\right) \tag{203}$$

$$\frac{P_1}{D_1^5 N_1^3 \rho_1} = \frac{P_0}{D_0^5 N_0^3 \rho_0} \quad ; \quad P_1 = P_0 \left(\frac{D_1}{D_0}\right)^5 \left(\frac{N_1}{N_0}\right)^3 \left(\frac{\rho_1}{\rho_0}\right) \tag{204}$$

$$\left(\frac{D_1}{D_0}\right) = \frac{42}{36} = 1.166; \quad \left(\frac{D_1}{D_0}\right)^2 = 1.361;$$

$$\left(\frac{D_1}{D_0}\right)^3 = 1.588; \quad \left(\frac{D_1}{D_0}\right)^5 = 2.161$$

$$\left(\frac{N_1}{N_0}\right) = \frac{1150}{600} = 1.917; \quad \left(\frac{N_1}{N_0}\right)^2 = 3.671;$$

$$\left(\frac{N_1}{N_0}\right)^3 = 7.035$$

$$\left(\frac{\rho_1}{\rho_0}\right) = \frac{0.045}{0.075} = 0.6$$

Accordingly, for corresponding operating points,

$$Q_1 = Q_0 \times 1.583 \times 1.917 = Q_0 \times 3.044$$
$$H_1 = H_0 \times 1.361 \times 3.671 \times 0.6 = H_0 \times 2.998$$
$$P_1 = P_0 \times 2.161 \times 7.035 \times 0.6 = P_0 \times 9.122$$
$$E_1 = E_0$$

We now pick off from the test curves for the Size 6 fan values of Q_0, H_0, P_0, E_0, and compute the corresponding values for the Size 7 fan. A few values are tabulated as samples.

Q_0	H_0	P_0	$E_0 = E_1$	Q_1	H_1	P_1
0	3.68	11.1	0	0	11.03	101.3
10,000	3.75	15.1	37.4	30,440	11.24	137.7
20,000	3.50	18.6	59.2	60,880	10.49	169.7
30,000	2.96	21.4	64.8	91,320	8.87	195.2
40,000	2.12	23.1	57.4	121,760	6.36	210.7
50,000	1.02	23.1	34.5	152,200	3.06	210.7
58,000	0	21.0	0	176,550	0	191.6

The computed values are plotted in Fig. 55 and give the characteristic curves for the Size 7 fan running at the specified speed and handling gas of the specified density.

In the foregoing computation it might appear preferable to use constant (d) for computing the power P_1, from the equation

$$P_1 = P_0 \left(\frac{Q_1 H_1}{Q_0 H_0}\right) \qquad (204.1)$$

This method would of course yield correct results if the arithmetic is good, but it is open to objection on two grounds. First, it uses two computed values as stepping stones for finding the power, and thus opens the way for the accumulation of errors due to imperfect arithmetic and to the rounding of the previously computed values. Second, it requires a different factor to be computed for each point, and thus involves more labor than the use of constant (c), as in equation (204), which provides a single constant for use at all points.

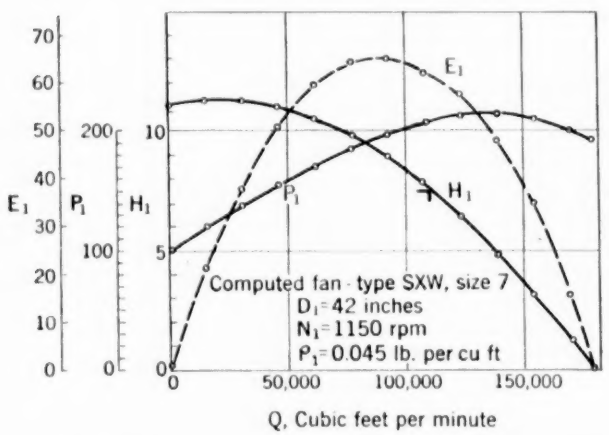


Fig. 55. Computed curves for a larger fan in the series represented by test curves of Fig. 54.

Second Method Using Fan Laws

Again we work point by point. For a chosen point on the test curve, Q_0, H_0 and P_0 are read.

These values are then changed by the density law; Q and E are the same; H and P are proportional to density. We compute values of H_a and P_a.

Next the fan size is increased at the same tip speed, i.e., DN is constant; $D_0N_a = D_1N_b = 36 \times 600 = 42 \times 514.3$. The speed $N_b = 514.3$ is an intermediate value of no final significance. In this change, Q and P are proportional to D^2, $H_b = H_a$ and $E_b = E_a = E_0$. We compute values of Q_b and P_b.

Finally change by the 1-2-3 law from N_b to N_1, 514.3 to 1150. Q is proportional to N, H to N^2, P to N^3. Compute Q_1, H_1, and P_1. $E_1 = E_b = E_a = E_0$.

Using the same values for Q_0, H_0, P_0, and E_0 that were previously picked off the curves of Fig. 54 and tabulated, the calculation proceeds:

Test fan with $\rho = 0.045$	42-in. fan same tip speed. $N_b = 514.3$	42-in. fan $N = 1150$
$\frac{.045}{.075} = 0.6$	$\frac{42}{36} = 1.167$	$\frac{1150}{514.3} = 2.236$
$Q_a = Q_0$	$\left(\frac{42}{36}\right)^2 = 1.361$	$(2.236)^2 = 5.000$
$E_a = E_0$	$H_b = H_a$	$(2.236)^3 = 11.18$

H_a	P_a	Q_b	P_b	Q_1	H_1	P_1
2.21	6.7	0	9.1	0	11.05	101.7
2.25	9.1	13,610	12.4	30,420	11.25	138.7
2.10	11.2	27,220	15.2	60,850	10.50	169.9
1.78	12.8	40,830	17.4	91,300	8.90	194.5
1.27	13.9	54,440	18.9	121,700	6.35	211.3
0.61	13.9	68,050	18.9	152,200	3.05	211.3
0	12.6	78,940	17.2	176,500	0	192.3

It will be noted that the results do not agree precisely with those of the previous method; this is due to the accumulation of errors in the numerous slide-rule operations required for this second method, and to the rounding off of intermediate values. When this second table is computed carrying an additional digit in all of the intermediate values (sub-*a* and sub-*b*), and computing by machine, the results agree within two units in the fourth digit, i.e., substantial identity results. This is of course as it should be.

The computation of intermediate items to more digits than are justified in the final results is a common practice, justified on the ground that it avoids the accumulation of minor irregularities.

This second method of converting fan performance is more laborious than the first one, and, as we have seen, it presents many more opportunities for arithmetic error, but some engineers find it easier to understand and remember. The first method is recommended.

Part 10, next month, will deal with the selection of fans for specific duties.

What Would You Do?

Replies to engineering and operating problems of interest to the industrial plant engineer

Conducted by
NATHAN N. WOLPERT
Associate Editor

MUCH thought has been given to the corrosive qualities of water and to the methods to be followed in reducing or correcting the resulting damage to pipe and tanks.

Corrosion inside return condensate lines may be due to one or two dissolved gases—carbon dioxide and oxygen. This type of corrosion is present in a number of industrial plants and therefore the replies received in answer to a problem based on pipe line corrosion should be of general interest to industrial plant engineers.

Should you have a problem that you would like to see discussed in this department, or should you have some comments that you would like to add to the discussion scheduled for a coming issue, you are invited to write to the Editor. Such letters are always welcome.

This is the Problem

We have been having what we believe is an excessive amount of corrosion in our condensate return lines. Although water treatment of some kind is indicated, we are confused as to what treatment is available and what such treatment will do to the water. The water delivered to the plant has been treated by zeolite to soften the water so that it can be used for washing textiles.

This Month's Problem

A large part of the damage done to condensate return lines is caused by dissolved carbon dioxide. This problem has been studied by a number of investigators in order to find a means for cutting down this maintenance expense.

The source of this carbon dioxide which distills off with the steam lies in the breakdown of bicarbonate and carbonate salts in the boiler salines as a result of heat and also through reactions with other water treatment chemicals. This condition is accentuated by sodium cycle zeolite softening of the makeup water which converts all alkalinity naturally present in the water, to the highly soluble bicarbonates and carbonates. Typical reaction illustrations of this breakdown follow:

(1) $NaHCO_3 + Heat = NaOH + CO_2$
(2) $Na_2CO_3 + H_2O + Heat = 2NaOH + CO_2$
(3) $3CaCO_3 + 2\ Na_2HPO_4 + H_2O = Ca_3\ (PO_4)_2 + 4NaOH + CO_2$

One fundamental solution to the problem of condensate return line corrosion lies in the reduction of the concentration of alkalinity in the feed water. An alternate approach consists of the feeding of palliatives such as amines (a class of compounds derived from ammonia) of either the neutralizing type or the film forming type. Preliminary reduction of makeup water alkalinity content is desirable in the latter case to minimize the dosage of amines required for effective protection.

Alkalinity reduction in the makeup has heretofore been accomplished by any of the following means:

(a) Acid treatment
  (1) Direct addition of acid to water
  (2) Hydrogen zeolite
(b) Hot or cold lime treatment
  (1) Supplemented by hot zeolite softening
  (2) Supplemented by cold zeolite softening
(c) Hot or cold lime-soda treatment

Process *a* forms free carbon dioxide as a byproduct which must be eliminated by some form of degasification. Treatment *b* and *c* combine thermal removal of carbon dioxide with precipitation of CO_2 as a part of the insoluble calcium carbonate.

There is a new ion exchange process designed for the reduction of dissolved alkalinity which is as simple as the familiar sodium cycle zeolite softener. This new process utilizes a highly basic anion exchange resin capable of regeneration with common salt.

The operating exchange capacity of the anion resin is exhausted when it is converted to the bicarbonate, sulfate and nitrate forms from the chloride form, necessitating regeneration. The regeneration process is a conventional one consisting of backwashing, regenerant introduction and rinsing.

A modification of this process is that a single unit can be furnished with a bed of both sodium zeolite and the new anion resin. Such a unit will simultaneously soften and dealkalize water. The two beds contained in the single unit can be simultaneously regenerated with a single solution of common salt, providing an advantage in salt economy.

N. C. Stratton,
Gilbert Associates, Inc.
Reading, Pa.

Problem for the Coming Issue

In one part of our plant we have to exhaust a mild sulfurous fume at temperatures about 150 to 170 degrees. Ducts back of this fan have a short life and replacement costs have mounted. I am interested in what others have done to protect the metal surface or to cut down the frequency of duct replacements.

Corrosion of return condensate lines may be due to dissolved oxygen or carbon dioxide, or may be due to a combination of both these gases. However, when the proper steps are taken to eliminate dissolved oxygen, such as by proper feedwater deaeration followed by the feed of a chemical deaerant, the chief source of return line corrosion will be carbon dioxide.

The presence of carbon dioxide in the steam is not prevented by deaeration of the boiler feedwater. Of course, any free carbon dioxide (gaseous carbon dioxide dissolved in water) present in the feedwater is completely eliminated by efficient feedwater deaeration and consequently is rarely a factor in return line corrosion. The carbon dioxide present in the steam, and which eventually becomes the chief factor in return line corrosion, is that quantity of carbon dioxide produced by decomposition of the bicarbonate and carbonate content of the boiler feedwater. Upon entering the boiler, the bicarbonate content of the feedwater breaks down under the higher boiler water temperature, liberating carbon dioxide gas in accordance with the following reaction:

(1) $2NaHCO_3 + Heat = Na_2CO_3 + H_2O + CO_2$
Sodium Bicarbonate + Heat = Sodium Carbonate + Water + Carbon Dioxide

In this reaction carbon dioxide is evolved and the bicarbonate is broken down to carbonate. This carbonate, together with any naturally present, also undergoes decomposition as follows:

(2) $Na_2CO_3 + H_2O + Heat = 2NaOH + CO_2$
Sodium Carbonate + Water + Heat = Sodium Hydroxide + Carbon Dioxide

These decomposition reactions show the source of the carbon dioxide content of the steam. At points of condensation in the system, the condensate is rendered acidic due to the presence of carbon dioxide which forms carbonic acid in the presence of moisture. Under these conditions, corrosion of return lines will occur. Corrosion due to the presence of carbon dioxide in the condensate (carbonic acid) will occur principally in the form of grooving. This is distinguished from corrosion due to the presence of dissolved oxygen which manifests itself principally in the form of pitting.

Sodium zeolite softening of a raw water converts all natural alkalinity to sodium bicarbonate. Based on 100% decomposition of sodium bicarbonate (equation 1) and 80% decomposition of sodium carbonate (equation 2), for each part per million (ppm) of bicarbonate alkalinity in the feedwater, 0.79 ppm of carbon dioxide are produced in the steam. Where carbonate alkalinity is present in the boiler feedwater, such as where the make-up water is lime-soda softened, for each ppm of carbonate alkalinity in the feedwater, 0.35 ppm of carbon dioxide will be present in the steam. Of course, the sodium hydroxide content of the boiler feedwater will not produce any carbon dioxide with the steam.

From this consideration it is apparent that in order to minimize return line corrosion, it is advisable to reduce the carbon dioxide content of the steam to a value as low as possible. This could be done by acid treatment of the sodium zeolite softener effluent so as to lower the bicarbonate alkalinity to a satisfactory level. A range of approximately 5 to 10 ppm alkalinity may generally be found suitable. Following acid treatment, however, it is necessary to aerate the water in order to expel the carbon dioxide produced in the reaction. This method of treatment entails close control and the installation of special feeding equipment, piping and materials of suitable construction.

The carbon dioxide content of the steam may also be reduced by employing a hydrogen zeolite softener in combination with the sodium zeolite unit. With this system, a predetermined percentage of the raw make-up water is passed through the sodium zeolite softening unit while the remainder is passed through the hydrogen zeolite unit in order to obtain a mixed effluent of desired alkalinity.

The condition of return line corrosion may also be corrected by feed of proper chemical agents to the system. These chemical agents include neutralizing amines and filming type amines.

Neutralizing amines include cyclohexylamine and morpholine. These volatile amines are fed to the boiler where they volatilize with the steam and combine with the carbon dioxide in the condensate to neutralize its acidity. Unlike ammonia, these amines, when used in low concentrations, are not corrosive to copper and zinc-bearing metals. While satisfactory reduction of carbon dioxide corrosion is obtained with the neutralizing amines, they provide no protection against oxygen attack should this gas be present. Since these materials function by neutralizing the acidity of carbonic acid, where high concentration of carbon dioxide are present, relatively high amounts of the amine are necessary.

The filming amines function by laying down on the metal surfaces contacted an impervious non-wettable film that acts as a barrier between the metal and the corrosive condensate, thus providing protection against both carbon dioxide and oxygen attack. Examples of amines used for this purpose are octadecylamine, hexadecylamine and dioctadecylamine. Unlike the neutralizing amines, it is not necessary to feed the filming type amines in direct proportion to the amount of carbon dioxide present. Consequently, except at low carbon dioxide concentrations, the filming type amines provide a more economical treatment than the neutralizing amines. For most satisfactory results, the filming type amines must be fed, in dispersed form, directly to the main steam line at a point where they mix well with the steam.

Richard B. Conlan,
Chemical Engineer
W. H. & L. D. Betz

Philadelphia, Pa.

Answer to Previous Question

The following comments are in answer to the problem presented in the previous issue regarding when and where it is justified to eliminate traps in unit heater installations:

The use of a trap on the return of a steam unit heater depends on whether the system piping requirements are such that pressure is needed in the return pipe to return the condensate from the heater to the boiler. Traps may, as a general rule, be omitted from the unit heater return connections only where the pressure in the return pipe to which it connects should be much the same as the pressure in the steam supply pipe. The wet returns of a one-pipe or a two-pipe gravity system are such instances. When

(*Continued on page* 144)

Experience is my Classroom

By T. W. REYNOLDS

• ELECTRICAL FLORICULTURE

Way back in time, imported tropical plants were warmed during cold months in some rude structure with simple stove or other direct means. Windows few and small admitted a measure of light. More being found necessary, the roof was made of glass, which departure created the greenhouse.

Both structure and equipment grew or expanded along with the size and number of plants. While pipe coils had length and could follow perimeters, cast iron wall radiators could pack more heat in a given space. Pipe coils and large distributing mains cut off valuable sunlight. When under benches they corroded in the humid and wet environment and radiated too much heat on nearest plants. Pipe coils sagged, became noisy and inefficient from air and water binding; doors got in the way of supply or return mains. So pipes were placed in trenches to corrode more, boilers were pitted to maintain pipe grades, or pumps were used.

Steam pipes were hotter than hot water pipes and heat was full on or off. Ceiling temperatures were high but fuel economy was low. Since hot water circulation by gravity was small, pipes were large. Water volumes were also large and would overheat the place at times and underheat it at other times. Controls could not make water temperatures respond to wind, outdoor temperature variations, the passing cloud, and variations in intensity, quality and total amount of heat from the sun.

In a greenhouse, heating was therefore flexible and simple. Variations of indoor temperature of a few degrees influence timing and quality of plant growth while cool night temperatures are required for certain plants to flower, although fortunately night control is simpler due to absence of sun.

Fin radiation and unit heaters are now used for the heating of greenhouses. Fin radiation provides a certain amount of convective heat and requires less space than pipe coils. Unit heaters are low cost, simplify the piping, and can be located overhead without too much shading effect. High ceiling temperatures are also eliminated. However, the immediate purpose of this writing is not to discuss the heating of the usual or commercial greenhouse, but rather the electrical heating, air conditioning, and other late developments pertaining to laboratories for plant research where heat economics is of little importance relative to results achieved.

In 1936 the writer lived near and often passed the Boyce Thompson Institute for Plant Research at Yonkers, N. Y. The brilliantly illuminated greenhouses at night created a blackout problem and intrigued the passing curious of which the writer was one. So stopping in he learned many things. It seems that in commercial greenhouses there was, and always will be, a great demand for better methods of speeding up plant growth. It had already been learned that electrical soil heating cable could produce a higher percentage of seed germination and a more uniform and vigorous plant growth in shorter periods than could be obtained by manure in hot beds. Attention was therefore directed to the use of lamps for longer lighting periods.

Since fluorescent lights had not then been developed, incandescent lamps adjustable for elevation were used to heat up the beds, speed the growth of plants and seedlings and produce more and better flowers. This type illumination proved a better heater than a light source, since about 90% of the energy input was converted into heat. This led to heating of the greenhouse entirely by lamps, and this in turn to the insulating of the structure. Valuable sunlight was utilized while it lasted, but at other times it was supplemented by artificial light.

Controlling thermostats were then set to deliver sufficient lighting periods to maintain the required temperature in the greenhouse. With low indoor night temperature of 55 to 60F, lamps were on for a period of 10 to 12 minutes, alternating with an off or dark period of 12 to 22 minutes. These minimums and maximums were with outdoor temperatures of 9F and 27F, respectively. During the daytime, lamps operated intermittently on cool cloudy days, but were never on when the sun was out, even if the outdoor temperature was zero. When the sunlight was bright, some of the storm sash had to be opened to keep temperatures down to 80F. One other greenhouse was not insulated and this required supplementary heat in the way of steam coils to maintain the same temperatures.

In the years 1937-1938 the average daily on-period was 3.4 hours per 24-hour day during the coldest months of December through February, and 1.6 hours during November and March. The value of sunlight may be realized from a study of New York Weather bureau data from which the energy in an average December day acre of sunlight is found equal to about 5,700 kw hours. It is also interesting to note that an acre of insulated greenhouse would require about 5,200 kw hours per day for both heat and light.

If plants are grown for transportation they must first be hardened by ventilation to reduce humidity and temperature and the amount of watering. Lighting for light and/or heat is also a problem. Fluorescent tubes must not be too close to the ceiling in stratified warm air, or where they shade too much sunlight. They can be placed close together and maximum lamp output obtained where cool conditioned air flows between them. Hence, the use of such type of lighting is made possible and effective by the use of air conditioning.

Infrared lamps provide radiant energy, do not overheat, are good spot heaters, and have worked well for germinating seeds in hot beds. They have been used in brooding chickens, pigs, lambs, and other animals, but not too extensively for greenhouse plants, because of the possibility that the light omitted may upset the blooming time of flowers. Combinations of fluorescent ad incandescent lamps are sometimes used in greenhouses. However, if the sole purpose is one of increasing the light hours in greenhouse, the ordinary filament lamp is the most practical. It has the correct spectrum for this and it is so small physically that it does not obstruct much of the valuable sunlight.

The common house plant bends toward the light and the potato in the darkened cellar sends out a long shoot looking for light, but the most interesting reaction of plants is their photoperiodism or response to daylight by successive rythmic periods of light and dark and the relative length of such periods. For example, the chrysanthemum is a short-day plant which will not bloom until fall when the days are short. The tobacco plant is a short-day plant, the china aster is a long day plant. Poinsettia plants in the home provide another example of photoperiodism, since in such locations they usually do not flower as they should at Christmas time. This is because the artificial night light of the home leaves but little dark period. This plant should be taken into some darkened room each night, in which event it will flower. In the laboratory they are shielded from light for the necessary period when the days are too long.

The experiments at the Boyce Thompson Institute for Plant Research did prove that plants would continue to grow under artificial light, but the newer concept of photoperiodism showed that the lights going on and off could affect the blooming time of plants adversely. To the best of my knowledge, this institute still has one of the older greenhouses heated and lighted in the manner described.

It is interesting to note that where a greenhouse located elsewhere, had an electric sign atop the greenhouse, the light interrupted the dark cycle of the poinsettia plants inside, just as a floodlight on a mink ranch upset the breeding cycle of the minks.

• PROGRESS IN GLASS BLOCK

The University of Michigan has been doing considerable research on the effect of glass blocks in a windowless but skylighted room. The blocks are made by the Kimble Glass Company and will be used for a school room in California where many classrooms are windowless. Windows in schoolrooms were once considered indispensable and many a controversy revolved around the benefits obtained from windows because of the dust through open windows. Without windows pupils concentrate on the blackboard rather than objects outdoors.

Pittsburgh Corning Corp. has also been furthering glass block research as have other producers. Glass blocks are made light directing for use above eye level and light diffusing for use below eye level to prevent light from being directed upward to the eye. Below desk level no blocks are needed. Some times a two-course of clear decorative block is used in industries as a vision strip through which to see out.

The prisms in light directing block direct light to the ceiling from whence it is diffused about the room and renders obsolete the old law for some schools that a room should be no more then twice as deep inward from the windows as the ceiling is high. Ceilings can be lower, consequently there will be less to heat and cool.

Glass blocks are easier to clean and maintain than sash. Replacements are easy to make and are few. Blinds, painting and plastering are not required. It is desirable where close temperature control is required or where processes cause condensation on glass windows. Skylights can be replaced with panels of glass block. Muckle Manufacturing Co., Owatonna, Minn. has a prefabricated shallow gravity fresh air intake for fitting into glass block or other construction. It contains filters, wind baffles and louvers adjustable inside. Outdoor air can be admitted directly into each room.

• THEY HAVE WEATHER IN ALASKA

In Alaska the mean temperature is really mean for some of the time. At Fairbanks, outdoor temperatures from zero to sixty below may be continued for as much as three weeks with a drop of 40F in as little as three hours. For a full week it may vary between 50F and 60F below. In one observed installation at 60F below outdoors, the hot water pump ran about 80% of the time and the burner about 50% with 180F boiler water. Yet there are times when air conditioning is needed because a June day may have as much as 22 hours of sunshine at 90F.

Dealers also have their troubles in Alaska. Although orders are easily secured, they are often given on the basis of a catalog, with delivery to the dealer months later, and to the customer at some distant location even later. One woman travelled 1,600 miles to Juneau to buy a dishwasher while an Indian living in a remote area bought an electric range; after finding no electricity in his village he returned and bought a small electric plant.

• AIR CONDITIONING NEWS

A cooling tower may only require one per cent of make-up water, but when this small percentage is actually 100,000 gph it is something to think about. And so some English power stations away from the sea or river use sewage effluent as make-up, in some cases diluted with water. Which brings to mind the hue and cry about water shortage and water consumption for air conditioning in the hot summer months. It is forgotten then that today we all use the bath room more frequently and use more water per visit when we are not sprinkling more lawns and building more industries. In many cases, in downtown New York, for example, where is the space in which to install water conserving equipment?

Canopies and awnings reduce the air conditioning load even when of sheet metal. These awnings can now be obtained with permanent baked enamel finish in green, blue and tile red. Awnings can be with white enamel inside to provide light rooms. Canopies have drain channels at the front to protect doors from ice, rain, snow and sun.

Doctors have recently commented upon the fact that patients in air conditioned hospitals do not have to struggle against heat, therefore recover faster, that cooling to reduce the heat from fever should be varied to suit the particular kind of infection. In banking circles it has been found that bank clerks make less errors in air conditioned surroundings.

PRODUCT APPLICATIONS

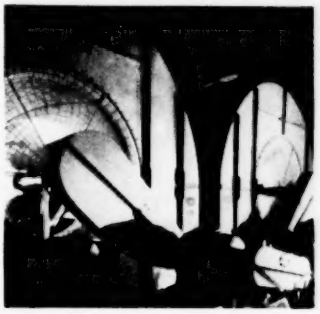
New, Unusual, or Ingenious Uses of Equipment and Materials

Conducted by WM. B. FOXHALL, Associate Editor

Airfoil Fans Serve Parkway Tunnels

PROBLEM: Part of the redevelopment program of Pittsburgh, Pa., is the Penn-Lincoln Parkway Squirrel Hill Tunnels which were opened to traffic on June 5. To handle fresh air requirements in the 4225 foot long, four-lane tunnels it was necessary to provide a ventilating capacity of 1,900,000 cfm of fresh air.

SOLUTION: Eight Westinghouse Sturtevant airfoil fans consisting of two blower and two exhaust fans located in ventilation buildings at each end of the tunnel, were specified. The tunnel consists of twin tubes of two lanes each with a barrier wall separating east and west bound traffic. Moderate traffic loads are handled by two fans for each tube. The other four fans go into action during morning and evening rush hours or in emergencies. Motors required to drive the fans have a combined capacity of 1350 hp. The two motors that drive each fan are geared to provide three speed operation.



Each tube is provided with a duct running the full length of the tunnel above the ceiling. At 15 foot intervals along the ceiling, there are open slots which permit the fresh air in the duct to be blown into the tunnel proper. A solid bulkhead halfway through the duct causes all the air in the duct to be forced down through the open slots. At the opposite end of the tube, another fan is doing the same air moving job in reverse. Foul air from the far half of the tunnel is drawn up through the slots into the duct and exhausted by the fans up a vertical stack.

Every possible precaution has been taken in case of a fire within the tunnel—an incident of major concern in any tunnel operation. Setting off any of 16 manually operated fire alarm stations in each tunnel immediately flashes a red light at the entrance of the tunnel stopping incoming traffic. Simultaneously, the location of the fire is indicated on the control board of the fan operator. Mammoth draw-bridge like gates are electrically adjusted in the duct passages permitting additional fans to exhaust the affected tunnel. With fans at each end of the tunnel turning at high speed and exhausting fumes and smoke, fresh air is rapidly drawn in through both entrances protecting passengers in stopped cars and permitting fire equipment to quickly move through the smoke cleared passages.

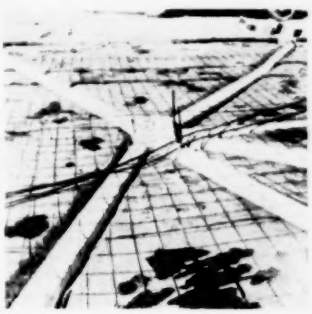
This is the first tunnel ventilating installation using air foil-bladed fans—a recent development pioneered in this country by Westinghouse. The blades of these fans have a cross-section similar to an airplane wing. Because of their higher efficiency, they use smaller driving motors, hence less electrical current, than conventional fans would require.

RESULTS: When the entire Penn-Lincoln Parkway is opened sometime in 1958, vehicles will be able to enter the limited access, high speed artery 10 miles east of Pittsburgh, travel in continually changing air through the heart of Pittsburgh, leaving the Parkway 9 miles west of the city.

Light Ducts Cut Costs

PROBLEM: A housing development in the Chicago area consists of 342 units of slab type construction. Warm air heating is specified with the aim of reducing costs wherever possible.

SOLUTION: Transite warm air duct, product of Johns-Manville Corp. was laid in the slab before the cement was poured.



RESULTS: Labor cost per house for installing Transite ducts runs around $6 as compared with $50 for clay tile ducts which were considered. Savings can be traced to the fact that Transite is manufactured in 10 an 13 ft lengths, reducing joints to a minimum. Lightweight material permits one man to handle any length. Joints are completed easily. No anchoring to prevent floating or protection to avoid deforming is needed. Since ducts are made of asbestos cement, no corrosion problem exists.

Central System Cools Motel

PROBLEM: In construction of the Mid-South Motel on Highway 80, east of Jackson, Miss., owner Samuel E. Lackey required air conditioning for each of 24 rooms.

SOLUTION: An air conditioning system utilizing U. S. Air Conditioning Corp. Modu-aire equipment and a Servel central chilled and hot water plant was installed. Each room is equipped with a control unit. Each unit is supplied with chilled or hot water through a piping system from a central equipment room where the chiller and heater operate on natural gas.

RESULTS: Guests have a choice of room temperature, which is maintained automatically. All air introduced by the system is filtered and dehumidified and is brought in from the outside through wall ducts.

Community Installs Snow Melting

PROBLEM: Residents and property owners on Hillcrest Drive in Coshocton, Ohio, were faced with dangerous driving conditions in winter, owing to the 15% grade and sharp curves of the street.

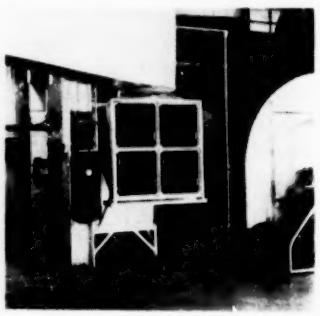
SOLUTION: Owners chipped in to pay for a snow melting system which now serves the 700-foot street. The system is privately operated by the owners as a community enterprise. It consists of wrought iron pipe coils laid directly on top of the old bituminous pavement and covered with two inches of black top surfacing. Heated water mixed with anti-freeze is circulated through the pipe which is spaced to provide traction area for wheels of cars using the street. Installation cost to each of the owners covered $513 including new paving and additional improvements. Cost of operating the system amounted to $116.40 the first season, which is prorated among the property owners. To operate the system during the first winter, two 250,000 btu capacity boilers were used with one pump. Plans for two more Hook and Ackerman boilers and two Bell & Gossett pumps have been made and the system will be put on automatic operation using an electric eye system.

RESULTS: The road has been kept clear for the entire winter. With boilers now served by natural gas, fuel bills are expected to average less than $10 per owner.

Air Drying System Saves $145 Per Day

PROBLEM: At the Ohio Match Co., the match-drying room had to be supplied with an atmosphere controlled to close tolerance both in temperature and humidity.

SOLUTION: An absorption-type humidity control system was installed to replace a mechanical refrigeration system. The latter had worked very well, but high operating costs became burdensome. A Kathabar system of humidity control was installed. Make-up air is dehumidified, mixed with recirculating room air, and cooled so that 70,000 cfm of moisture is delivered at 70F and 32T R.H.



RESULTS: Because it is no longer necessary to cool exclusively for dehumidification, overall efficiency is higher and operating costs are lower. The company believes the new system will pay for itself within two years.

Chinchillas Thrive in Cool Air

PROBLEM: Hal Merchant, owner of the Merchant Chinchilla Ranch, Allen, Oklahoma, required cooling to keep his animals healthy and in breeding condition.

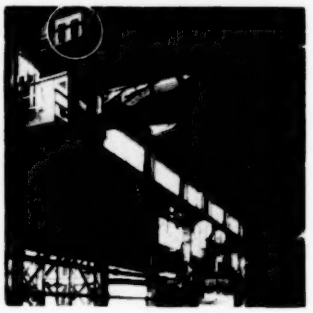
SOLUTION: A Mitchell room air conditioner was installed in the chinchilla house.

RESULTS: Chinchillas thrive in temperatures of about 65F. Animals require conditioned fresh air which is provided by the unit. Normally the chinchilla will not breed during the hot months, but with air conditioning there is no slack season.

Crane Cab Air Conditioned

PROBLEM: The operator of the traveling crane at the Monessen Plant of the Pittsburgh Steel Co. was subjected to excessive temperatures caused by hot slabs of steel in the rolling mills.

SOLUTION: A Dravo Corp. Model C-5SP split-unit cab cooler was installed. Designed with thermostatic control for automatic operation, the unit maintains 80 to 85F in summer when the ambient temperature is 150F. The evaporator section is located inside the cab and the condenser section on the crane bridge above. The two units are connected by refrigerant piping. Condenser and motor are air cooled.



RESULTS: Crane operator is shielded from high temperatures and fumes and is able to work efficiently throughout the summer.

Steam Traps Heat Tar Bath

PROBLEM: A continuous dipping system at the Rudisill Foundry Co. at Anniston, Ala., uses a heated tar bath in which pipes and fittings are dipped for coating. With four banks of steam pipe coils, it required four hours and forty-five minutes to effect a 30-degree temperature rise.

SOLUTION: A new heating system consisting of plate-coils equipped with 36 Yarway impulse steam traps was installed.

RESULTS: No difficulty in raising and maintaining operating temperatures is experienced. The same 30-degree temperature rise can be equipped in only three hours and ten minutes. Casting tonnage has been stepped up from 90 to 125 tons per eight hours.

Abstracts AND Reviews

Publications abstracted in this department should be ordered direct from publisher.

PIPE AND TUBE BENDING

Pipe and Tube Bending, by Paul B. Schubert is a practical working manual which describes and illustrates all of the common methods of bending ferrous and nonferrous pipe and tubing, the machines, fixtures, and devices used and it presents data and pointers that are useful in both the shop and the field. The book has been written for shop and field men, designers and engineers who are concerned with the bending of pipe and tubing for all type of indoor and outdoor applications. The descriptive information and data are so arranged that the reader can readily compare the various methods and become familiar with their respective advantages and limitations.

An entire chapter is devoted to the layout of pipe for bends. Formulas employed for various degrees of bend are included plus information and data concerning minimum radii of bends.

The content of the book is given in the following chapters and appendices: methods of bending, lengths and minimum radii of bends, use of fillers and mandrels in bending, compression bending, draw bending, ram and press bending, roll bending, wrinkle-bending, hot bending of large sized pipe and tubing, production pipe bending using wooden forming dies, pipe- and tube-coiling, bending operations in the field, procedure for dimensioning drawings of bent parts, and classification of tubing.

A large number of halftone illustrations and line diagrams are included together with fifteen helpful tables which add to the value of the book as a practical working manual.

Pipe and Tube Bending, by P. S. Schubert. Cloth bound, 6 x 9 inches. 183 pages. Published by The Industrial Press, 148 Lafayette St., New York 13, N. Y. Price, $5.

AUTOMATIC CONTROL

A practical book on a subject not treated before in such extensive form, is Automatic Control of Heating and Air Conditioning, by John E. Haines, vice president, Minneapolis-Honeywell Regulator Company. Starting from basic principles, this book progresses through the construction and characteristics of representative control devices.

As the science of heating and air conditioning advanced so did the science of automatic control for this highly specialized field developed new demands for controlling burners, compressors, blowers and other parts of such systems. The basic objective of this book is to explain and illustrate the principles and operation of the various controls used in heating and air conditioning. It is not intended to be an installation and service handbook.

Controls are not generally understood by most engineers and for that reason the author is to be complimented for treating his subject as simply as possible and without involved mathematics. There is a need for this information for it seems that although many volumes have been written on the science of heating and air conditioning up to this time, there has not been a practical book on controls.

The subject matter has been grouped as to type of circuit and application in the following chapters: Fundamentals of control; fundamentals of measurement; electric control circuits; pneumatic control circuits; control of domestic heating; zone control—commercial heating; control of unit heaters and unit ventilators; control of commercial central fan heating systems; control of commercial central fan cooling systems; control of commercial refrigeration; control of radiant panel heating.

The book is well illustrated with clear easy to follow line drawings.

Automatic Control of Heating and Air Conditioning, by J. E. Haines. Cloth bound, 6 x 9 inches, 370 pages. Published by McGraw-Hill Book Company, 330 W. 42nd St., New York 36, N. Y. Price, $6.75.

WATER HEATERS

Valuable information on the installation and servicing of gas-fired water heating equipment is presented in the fourth edition of Gas Appliance Service Water Heater Manual, prepared by a committee of the American Gas Association.

It provides general instructions on the selection, installation, cleaning, adjusting and lubrication of domestic gas water heaters and their controls for all types of utility gases.

The four sections of the manual cover selection of the water heater, installation of water heaters, servicing of water heaters, and specific servicing instructions for the common types of water heaters and controls. In this edition, Part IV has been condensed to bring out the essential information that would be helpful to the service man. All four sections of the manual have been reviewed and revised to bring the text in line with current industry thinking and practices.

Gas Appliance Service Water Heater Manual. Ring binder, 7¾ x 5¾ inches. Published by American Gas Association, 420 Lexington Ave., New York 17, N. Y. Price, $2.

PUMPS

Next to electric motors, pumps rank as the most generally used industrial equipment. Therefore, it is safe to assume that many will be interested in factual data both on new pump designs and applications to keep them abreast of the latest developments.

This book by Frank A. Kristal, New York District Manager, for Weinman Pump Manufacturing Company, Roy E. Roth Company, and Wagner Steam Pump Com-

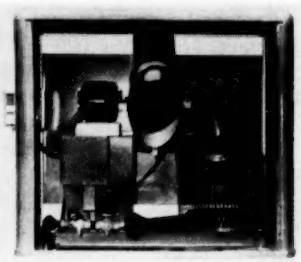
(*Continued on page* 147)

NEWS OF EQUIPMENT AND MATERIALS

Use the prepaid postcard opposite page 131 for securing additional information on items described in this department.

Gas Heater Improved

Line voltage controls for easier installation, greater dependability, and less upkeep of heaters, are used on new models of its gas-fired floor and suspended heaters, according to Kilbury Mfg. Co., Inc., Lawndale, Calif. These controls will replace the low voltage controls of former models and eliminate the maintenance problem created by their use with irregular line voltages found in industry.



Cabinet enclosed models have been improved by addition of an air intake grille in front to supplement an opening in the back, which cools the metal cover to an exceptionally low temperature. Illustration shows cabinet with front panel removed. The heater is a blower-type unvented unit used for heating industrial and commercial buildings.

The thermostat is now mounted on the chassis without sacrificing effectiveness. The thermostat can be locked by a key which is removable, making it difficult for employees to tamper with the setting. It can be detached for wall mounting and the wiring concealed on new construction.

Floor and suspended models are available in 40,000 and 50,000 Btu per hour capacities.

More information? Circle Item 1 on postcard, page 131

Machine Drills Concrete Floors

The Mole, a machine for drilling large holes in concrete and masonry, has been developed by Molco Drilling Machines, Inc., Washington, D. C. Use of this machine is said to be the most economical method of drilling holes up to 6 inches in diameter for running service lines through floors for piping and plumbing lines.

Reinforcing bars or hard aggregate are no obstacle to the machine. To use, the machine is placed over the desired spot, cutting compound and water placed in the cup, the motor turned on and the drill operates. Holes can be drilled at any horizontal surface.

The machine is available in three models with capacities of ½ to 3 inch diameter, a second, ½ to 4 inches, and a third, ½ to 6 inches. They will drill up to 18 inches deep.

More Information? Circle Item 2 on postcard, page 131

Decorative Round Thermostat

A new improved home thermostat, the T-86, that is round instead of rectangular and is designed so that it can be decorated to suit individual homes and tastes is announced by Minneapolis-Honeywell Regulator Co., Minneapolis, Minn. The new instrument, which actually is the shape of half a sphere, combines important engineering changes with its new look. It will become the company's standard thermostat for home use.

The decorative features are unique. First, the round design itself is eye-catching and is styled from the standpoint of modern home decorating trends. Secondly, the cover can be easily removed without tools and painted to match any decorating theme.

Chief among the engineering improvements is an enclosed, dust-free mercury switch which will eliminate the open contact chronic maintenance problems of the older types. Also introduced for the first time is a bi-metal temperature indicator. An easy-to-read dial replaces the old clinical type thermometer traditionally used in heating thermostats. The temperature indicator and the control scale are combined in one easily read dial. The thermostat is set by turning a simple, knurled plastic ring.

In developing the new device, engineers have recognized the fact that users often tend to push the control setting up or down, then forget they have done so, resulting in dangerous over or underheating. In the new instrument, temperature adjustments are provided covering accepted comfort limits. Included are adjustable stops to prevent the chronic thermostat jiggler from continually getting an uncomfortably high or low setting.

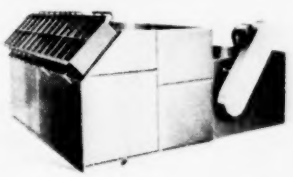
The new thermostat is of the time modulation type with a planned pattern of *on* and *off* cycles per unit of time to match the heat losses at a given load. Thus, at a 50% load, there are approximately 6 burner cycles per hour, 5 minutes on and 15 minutes off. As the load increases from 50%, the frequency of burner cycles is decreased with the *on* periods becoming progressively longer and the *off* periods shorter until, at 100% load, the burner is on continuously. Similarly, with a decrease in load from 50%, the frequency of burner cycles also decreases, but with *off* periods progressively longer until at zero load the burner is off continuously. Between the extremes of zero and 100% load, there are an infinite number of ratios. This time modulation is accomplished by use of a heater in series-parallel with a spiral bi-metal element.

A feature of the instrument is its fixed differential. The differential is not widened to adjust for longer *on* periods if the heating system is not of correct size; rather, the heater is adjusted to lengthen or shorten the burner *on* cycles as required.

More Information? Circle Item 3 on postcard, page 131

Multi-Zone Air Conditioners

A new line of multi-zone air conditioners which provide both cooling and heating from a single unit to any number of separate conditioned areas, each with individual temperature control, is introduced by United States Air Conditioning Corp., Minneapolis, Minn. The units are particularly adapted to multi-room building applications where independent and variable cooling and heating loads are encountered.



The equipment is being offered in four models, designed to serve up to 12 to 16 separate zones and ranging in capacity from 7,500 to 18,000 cfm. The units are of sectional construction, consisting of filter, blower, heating coil, cooling coil and multiple zone mixing damper sections.

Designated Type B multi-zone air conditioners, the units are of the blow-through type. Air leaves the fan discharge and passes from the cooling or heating coil to the multiple zone damper section from which it is discharged through as many separate air streams as required for the individual zones. The mixing dampers for each zone operate independently. In this way, independent temperature regulation can be obtained for each zone and each separate air stream, whether it be for heating or cooling.

During the cooling season when no heat is required, the heating coil and hot deck dampers act as a by-pass. During the heating season, the cooling coil and cold deck dampers act as a by-pass if no refrigeration is required. However, both the heating and cooling coils can be left in operation the year around if required so that both heating and cooling can be obtained simultaneously for separate zones.

More Information? Circle Item 4 on postcard, page 131

7 New Sizes Gas Unit Heaters

Seven sizes of gas fired unit heaters have been added to the Herman Nelson line of unit heaters, according to American Air Filter Co., Inc., Louisville, Ky.

The new heaters are suitable for use on all types of natural, manufactured and liquefied petroleum gases. Heat output ranges from 20,000 to 160,000 Btu per hour, with fan diameters from twelve to twenty inches.

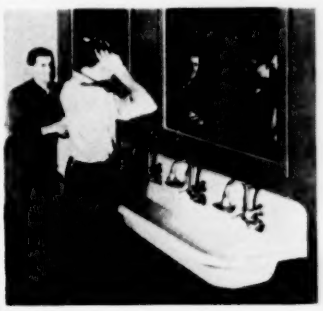
Finished in a grey-green baked enamel, the units are suited for installation in stores, lobbies, studios, small offices, and similar applications where appearance is a prime factor, and where a central heating system may not be available.

The units are described in Bulletin 715.

More Information? Circle Item 5 on postcard, page 131

Industrial Wash Sink

Restyling of the Brockway, its wall-hanging industrial wash sink, is announced by Kohler Co., Kohler, Wis.



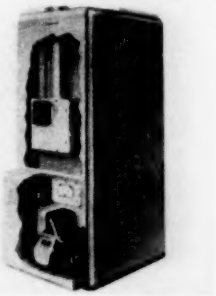
Designed for use in factories and other heavy-duty installations, the sink is built of acid-resisting enameled cast iron, making it durable and easy to clean. The sink is equipped with mixer type faucets and sprays. Soap dishes attached to the back of the fixture are a feature. There is a high area splash-back to protect walls.

The sink is available in 4, 5, and 6 foot lengths. The 5 and 6 foot models are equipped with three faucets and two soap dishes, while the 4 foot size has one soap dish and two faucets. The wall-to-front measurement is 17½ inches. Depth at the outlet is 7½ inches, and at the back, 8 inches.

More Information? Circle Item 6 on postcard, page 131

Compact Oil-Fired Furnaces

Development of two new oil-fired, forced air furnaces with minimum space requirements is announced by Bryant Heater Div., Affiliated Gas Equipment, Inc., Cleveland, Ohio. These furnaces, Models 314 and 315, are compactly styled to permit quick, simple installation in almost any part of the home.



Engineered primarily for perimeter warm air heating applications in basementless homes, Model 314 (illustrated) is a down-flow type, featuring the warm air outlet at the bottom of the unit and the return air inlet at the top.

The Model 315 is the vertical type, listed for basement, utility room or closet applications. It utilizes a UL-approved pressure atomizing type burner that operates within an insulating brick combustion chamber.

Available in six capacities from 75,000 to 144,000 Btu per hour, both heaters are serviced from the front side only, simplifying installation and servicing in even the smallest enclosed areas.

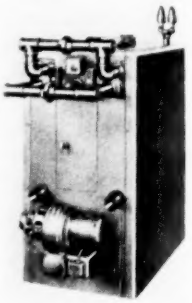
A heavy-gage heat exchanger on both units is of the drum type with a wrap-around doughnut radiator at the top. This design helps to make the furnaces as compact as possible while at the same time assuring efficient heat transfer.

Providing better, cleaner combustion and higher operating efficiencies, the ceramic combustion chambers of both units are of the insulating firebrick type and heat to a red glow in seconds, assuring clean combustion and high CO_2 percentages.

More Information? Circle Item 7 on postcard, page 131

Large Volume Water Heater

An indirect oil or gas fired water heater capable of delivering volumes of hot water at required temperature or two given temperatures is announced by Bryan Steam Corp., Peru, Ind.



The heater makes use of copper tubes for both direct and indirect heating, having a nest of removable tubes for primary heating, the tubes being positioned directly over the flame. Heated water rises in the boiler where a copper tube heat exchanger carries the secondary flow for heating to the lower of the two temperatures. Circulation is usually through the exchanger to a storage tank, although the boiler is supplied without the tank for certain applications, such as in swimming pool heating where the pool is, in effect, its own storage tank.

When a second and higher temperature is required the water is recirculated through a second heat exchanger that boosts the water to the required temperature.

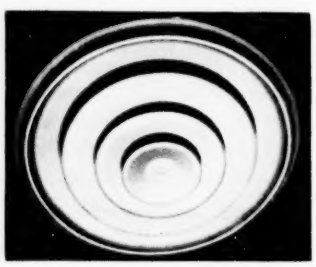
One of the principle advantages claimed for the heater is that the direct heating is in a closed circuit. Water, once introduced, is circulated and re-circulated through tubes and boiler, eliminating the usual problems deriving from scale and other deposits. Fresh water supplies are introduced only in the secondary heat exchanger coils which are exposed to no temperature higher than that of the water in the boiler. Long life of both tubes and boiler is a normal expectancy.

The heater is made in eight sizes with BTU outputs of 140,000 to 1,600,000 Btu per hr. In gallons per hour, the capacities are from 268 to 3,020 with a 60 deg. temperature rise; for a 140 deg. rise, capacity is from 112 to 1,300 gallons per hour.

More Information? Circle Item 8 on postcard, page 131

Ceiling Air Diffusers

A new series of circular ceiling diffusers is announced by W. R. Carnes Co., Verona, Wis., available in sizes from 5 through 32 inches. These Model E series units embody the same characteristics of easy installation and simple adjustment that have proved successful in previous models.



The series includes three identically styled models to assure harmonious appearance when it is necessary to use more than one model in the same installation. Each size diffuser contains the same number of cones which results in uniform appearance when various sizes are installed in the same area.

Model E is a fixed cone diffuser in which the cone assembly can be set in any one of three positions to secure a horizontal, vertical or intermediate air pattern.

The Model EJ diffuser is a completely adjustable supply unit where any desired air pattern from horizontal to vertical can be easily and quickly obtained by rotating the small center plate. By rotating this center plate clockwise, the inner cone assembly is raised to its highest position, thereby deflecting the air downward for a vertical pattern. By rotating this center cone counter clockwise, the inner cone assembly is lowered to the bottom position, giving a horizontal air pattern. Any desired air patterns between these can also be easily obtained.

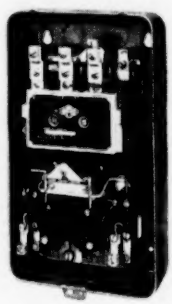
Model ER is an efficient combination supply and exhaust diffuser that is used when it is desirable to bring in the supply air and exhaust the room air from the same location. The air pattern is set to minimize the danger of short circuiting the supply air.

A full range of accessories such as volume controls, equalizing deflectors and anti-smudge rings, are available for all sizes.

More Information? Circle Item 9 on postcard, page 131

Intermediate Magnetic Starter

A new size magnetic starter and contactor series has been introduced by Furnas Electric Co., Batavia, Ill. Neither a conventional size 2 nor size 3, these new intermediate controls are designated size 2½ by the manufacturer.



Because the horsepower rating overlaps the size 2, many applications heretofore requiring the purchase of a size 3 control can now use the 2½, thereby saving considerable cost. The smaller physical size is also an advantage.

These controls which include reversing types are rated 20 hp at 208-220v, 30 hp at 440-550v. AC polyphase; some are available with built-in push buttons or selector switch.

More Information? Circle Item 10 on postcard, page 131

Aluminum Welding Rod

A new cast aluminum welding rod for torch work in assembling, repairing, and reclaiming sand castings of aluminum is announced by All-State Welding Alloys Co., Inc., White Plains, N. Y. It is identified as No. 355 cast aluminum welding rod.

More Information? Circle Item 11 on postcard, page 131

Correction

Incorrect sizes of a new line of propeller fans introduced by The Bishop & Babcock Mfg. Co., Cleveland, Ohio, were given in the item in last month's issue announcing the line.

Direct drive fans are offered in 6 sizes in diameters from 12 to 30 inches, while the belt-driven fans are in 5 sizes in 24 to 48 inches.

3 Water Treating Products

Three new water conditioning products designed to help maintain the efficiency of water cooling equipment in air conditioning systems have been developed by Garman Co., Inc., St. Louis, Mo.

The first, known as Vapco Preventive, is for use in new water cooling equipment, or old equipment which has been conditioned by the other two products. Its purpose is to keep condensers clean and operating at top efficiency.

Recommended amounts for treatment are one 20 oz can of preventive powder per month for each 10 tons of refrigeration capacity in water having a hardness up to 12 grains.

Vapco Slime-X, the second product, is for use as a shock treatment to effectively kill slime bacteria and algae growth. Whenever slime bacteria, fungi or algae propagate in an evaporative condenser or cooling tower, one specie predominates. Each specie exhibits a toxic dose to an algaecide, fungicide or bactericide. The only proper treatment to eliminate such organic growth from the system is to perform shock treatment. Shock treatment is the application of a bactericide, fungicide or algaecide far to the right of the toxic dose curve to perform rapid kill and removal of the objectionable organisms.

The third product, Vapco Cleaner, is an acid type salt designed to remove scale and other incrustants which may have accumulated on equipment through lack of proper water treatment.

More Information? Circle Item 12 on postcard, page 131

Warm Air Panel Heating System

The Airfloor panel heating and cooling system using air as the heating or cooling medium is being marketed by Leemhuis Airfloor Co., Pomona, Calif. The system is a double-deck concrete floor construction which consists of two comparatively thin concrete floor slabs, the top slab forming the flooring surface being supported and separated from the lower slab by thin metal forms shown in the illustration. These forms are locked together to cover the whole floor area so as to produce a catacombed air space.

An advantage of this system is said to be that the comparatively thin concrete slab prevents heat lag. The warm air passed through the floor system is released through continuous baseboard registers so that both radiant and convection heating with continuous ventilation are provided.

This system gives the advantage of warm dry floors with uniform temperature and regular filtered air circulation. Simplified controls are used for single or multizone control. Gas, oil and electric furnaces or hot water or steam coils with blowers are utilized as the heating source. Using this plenum type floor also permits inexpensive radiant heating systems for basementless buildings in extremely cold climates.

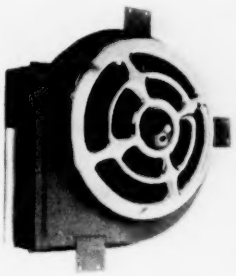
Floor panel cooling using this construction has been successful in California. Both refrigeration and evaporative cooling have been used through the floor.

Franchises are available. Descriptive folder will be sent on request.

More Information? Circle Item 13 on postcard, page 131

350 cfm Aluminum Blade Fan

The best features of the squirrel cage blower and axial flow fan are said to be combined in the new Marco V8 fan introduced by Marvin Mfg. Co., Los Angeles, Calif.



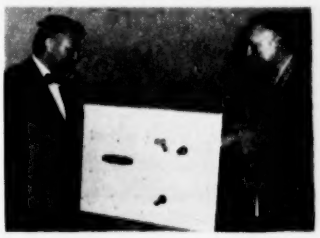
Maximum air movement is accomplished by a blade driven by a floating power motor, the blade being of aluminum alloy. All parts are easily accessible for fast installation. By loosening one easy-to-reach screw the J-Box cover slides out, leaving the J-Box wide open for wiring. After plastering, the pre-wired motor plugs into a handy receptacle.

The fan unit is 3¼ inches thick. Standard finishes are chrome and white enamel. The discharge rating is 350 cfm or 300 cfm of free air.

More Information? Circle Item 14 on postcard, page 131

Summer Air Conditioner

A summer air-conditioning system for homes which requires no water and which can be installed in waste space is announced by York-Shipley, Inc., York, Pa.



Packaged in two metal boxes, the air conditioner is called the Shipley Homeaire conditioner. The generator unit is designed for installation in a carport or protected outdoor location while the conditioner unit can be placed in any ceiling location in the home for connection of grilles or ducts.

The generator unit is 32 inches wide, 13⅞ inches high, and 27 inches deep while the conditioner unit is 28 inches wide, 21 inches high, and 23⅝ inches deep.

More Information? Circle Item 15 on postcard, page 131

New Ceiling Diffuser Line

The Type P Series is added to its line of Aerofuse ceiling diffusers by Tuttle & Bailey, Inc., New Britain, Conn.

The new line consists of five diffuser types, each designed to meet a specific air delivery requirement. Type PA is an adjustable, multi-passage diffuser mechanically designed so that the air distribution pattern may be varied from horizontal to vertical. It is intended for installations where spot cooling or spot heat is required, for exceptionally high ceiling applications, or for other applications where air pattern adjustability is desired. Pattern is adjusted by turning the center cup of the diffuser.

Other diffusers in the line include Type PS, stepped-down type, fixed pattern diffuser; Type PF, flash type, fixed pattern diffuser; Type PR, flush type, fixed pattern supply and return diffuser; Type PH, flush type, fixed pattern half round diffuser.

Features of the new series are the matching facial contours of all diffusers and the identical number of rings of all types and sizes. Thus when requirements call for the installation of more than one type or more than one size, uniform appearance is assured. To facilitate installation, all Type P diffusers have a removable center ring assembly.

Catalog 105 is available.

More Information? Circle Item 16 on postcard, page 131

Detects and Repairs Leaks

All equipment required for accurate leak detection as well as the necessary heating and brazing of refrigeration and air-conditioning systems is included in the Prest-O-Lite refrigeration and air conditioning outfit introduced by Linde Air Products Co., a Div. of Union Carbide and Carbon Corp., New York, N. Y. It gives the refrigeration serviceman a portable, all-purpose kit to handle any job he may meet while repairing or installing refrigeration equipment.

The supersensitive halide leak detector stem in the outfit assures accurate and positive detection of refrigerant gas leaks. It quickly locates leaks of such gases as F-11, F-12, F-21, F-113, F-114, and Carrene; also methyl bromide (fumigant) vapors in air, where such concentrations are less than 10%. The detector readily shows up as little as 20 parts of refrigerant gas in a million parts of air. Because of the sensitivity of the reaction plate and the flexibility of the 3-ft suction hose, leaks can be located rapidly with pin-point accuracy.

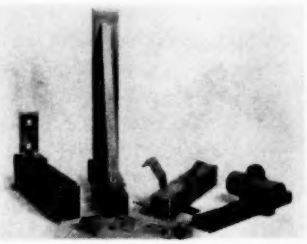
The outfit includes three torch stems to provide exactly the right flame for all open-flame soldering, heating, and bending required on refrigeration equipment. The stems fit interchangeably into the No. 401 precision handle. A built-in gas-miser pilot flame control on the handle saves time and fuel during intermittent work.

In addition to the handle, leak detector stem, and three torch stems, the outfit includes the R-411B acetylene regulator, which maintains selected pressure at the torch regardless of tank pressure, and a 12½ ft length of 3/16-inch acetylene supply hose. A steel carrying case holds the complete outfit.

More Information? Circle Item 17 on postcard, page 131

Framing for Pipe Support

Versabar, a versatile structural steel framing member is anounced by M-H Standard Co., Jersey City, N. J. The channel is made from cold rolled carbon steel in four basic sizes to provide a broad range of strength adaptability.



The usefulness of the member is enhanced by a variety of standard and special fittings, brackets and nuts which are available for prompt delivery. Serrated nuts are specifically designed for use with channels and will be furnished with or without springs.

Applications, for which a wide range of connecting fittings are available, include: motor bases and supports, pipe clamps and supports, pipe galleries, process piping supports, and tunnel framing.

There is no welding or drilling required. Assembled racks have the strength of welded units yet can be easily taken apart and are 100% reusable. The hardened serrations on the face of the nut bite into the channels to form a secure slip proof seat.

More Information? Circle Item 18 on postcard, page 131

Chemical Feed Pumps

A line of chemical solution feed pumps is being manufactured by Precision Machine Co., Somerville, Mass. These pumps, of the heavy duty, positive displacement, diaphragm type, are intended for chlorinating drinking water, swimming pools, and industrial wastes, and also have applications in connection with water treatment in heating and air conditioning. They are commonly used to feed chemical solutions for preventing corrosion, scaling, and organic growth in pipe lines, tanks, boilers, and cooling towers.

Bulletin PM20 is available.

More Information? Circle Item 19 on postcard, page 131

Non-Corrosive Oil Filter

A fuel-oil filter for all types of oil-heating applications is announced by A-P Controls Corp., Milwaukee, Wis.

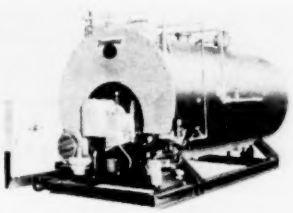
Designated as the Model 243-SY fuel-oil Trap-It, the unit has a fine-mesh monel-metal screen with an extra large strainer surface to trap foreign particles in the oil. The monel-metal is highly resistant to corrosive acids occasionally found in fuel oil, is quickly removable for cleaning and never requires replacement. It is rated at 2¾ gallons per hour on No. 3 fuel oil, and up to 5½ gallons per hour on No. 1 or No. 2 oil. The unit is made in two connection sizes, ¼ or ⅜ inch I.P.T.

Due to the design of the device, dirt and foreign matter are trapped on the outside of the strainer, from which it is easily removed. Particles of dirt and water are trapped in the sediment chamber at the bottom of the body. The body is removed for access to the strainer and for cleaning merely by loosening two wing nuts. No screw-driver or other tool is required.

More Information? Circle Item 20 on postcard, page 131

Boiler-Burner for Power, Heat

A new pressurized boiler-burner unit has been developed for high or low pressure heating, power and process steam. The unit, sold and serviced as a completely packaged plant, represents the work of two separate companies, Titusville Iron Works Co., Titusville, Pa., which designed the boiler; and Iron Fireman Mfg. Co., Cleveland, O., which developed the burner system.



The new boiler-burner unit operates on oil, gas, or oil and gas combination, with switching of fuels accomplished in seconds. The unit is shipped completely assembled on steel skid, and is ready for operation as soon as fuel, water, steam and electrical connections are made.

The boiler is of ASME Code construction throughout, and was designed with unusually large furnace volume to assure lower heat release, with proportional longer service life. Tubes are arranged in staggered rows so that release of steam from tube walls is speeded by a wiping action which increases efficiency of heat transfer. Other boiler features include ample steam disengaging surface to insure dry steam, ample openings for ease of access and cleanability, davit flue-door suspension for easy one-man operation, and removable gas-tight rear cover plate.

The fully automatically-controlled Iron Fireman burner unit has a turndown of 5 to 1, and will operate at over 80% efficiency through its entire modulating range, burning either gas or oil. The fully automatic control center is alert to any possible change in boiler load or abnormal operating conditions. A volumetric oil control meters by volume the exact quantity of oil needed for varying loads, and an automatic oil heating system keeps heavy oil at the correct temperature and viscosity for efficient combustion.

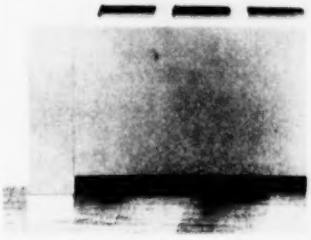
The unit is supplied in two basic types, power units and heating boilers. The power units are built in a complete capacity range from 37 hp to 363 hp, at normal SBI rating, with certified output ratings from 56 hp to 545 hp. The heating boilers are built in sizes from 4250 to 42,500 sq. ft. EDR at normal SBI steam ratings with certified output ratings from 6375 to 63,750 sq. ft. EDR.

Bulletin B-3133 is available.

More Information? Circle Item 21 on postcard, page 131

New Baseboard Radiator

The Trimrad baseboard radiator is available from Waterfilm Boilers, Inc., Jersey City, N. J. It is said to emit 50% of its heat by radiation and 50% by convection.



Three large hot water water-ways, directly backing the front panel, hold 1.1 quarts of water per linear foot. In combination with all welded steel construction which permits quick heat transfer, the welded steel construction, using mill rolled stock has a smooth surface, resulting in effective radiation.

Installation can be made for either standard or recessed mounting. Because of its light weight, 5 pounds per linear foot, one man can handle the largest baseboard unit. Step-by-step instructions accompany each baseboard which is shipped.

A pocket calculator which helps figure radiation and automatically converts the result to the Btu output required, is available.

More Information? Circle Item 22 on postcard, page 131

Motor Valve for Volatile Fuel

A bellows-sealed diaphragm motor valve has been developed for use with volatile and toxic mediums by Valve Div., Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

The pneumatically operated valve, listed as Type 27, handles flowing mediums such as gasoline, water mixtures, alcohols, ethers, ketones, kerosene, and jet fuels.

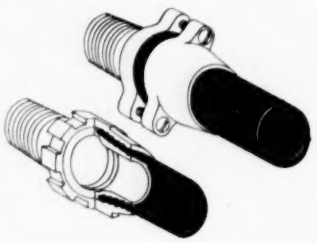
Features of the valve are a bronze bellows serving as a stem seal to prevent the escape of the fluid and a composition disc, Thiokol, for tight shut-off. Other composition materials are available for special applications.

The valve is available in standard sizes from 1 inch to 3 inches, and will provide tight shut-off with any pressure drop from 0 to 60 psi in all body sizes.

More Information? Circle Item 23 on postcard, page 131

Fittings for Plastic Pipe

Barracuda brass fittings, a new and efficient means of connecting plastic piping, are announced by Nelson Foundry Co., Morton Grove, Ill. They are designed so that the barracuda teeth grip the plastic inside and outside of the pipe completely overcoming the plastic cold flow property which has made non slip joints difficult. An important feature is the fact that they do not cut down flow through the pipe as they require no space inside. The fittings are easily removed and can be used many times with full efficiency. The price is in line with types of fittings now used.



Assembly is simple. The sleeve is slipped over the pipe and the tapered adapter or coupling inserted in the pipe. As the sleeve is tightened the setback teeth grip the pipe permanently.

The fittings come in sizes of ½, ¾, 1, 1¼, 1½ and 2 inches. Closures are available both in fillister screw and spanner types. All parts are made of brass.

Bulletin AX-200 is available.

More Information? Circle Item 24 on postcard, page 131

Adsorption Dehumidifier

Adsorption-type dehumidifiers of a new design in decorator finishes for home use are announced by Dryomatic Corp., Alexandria, Va.

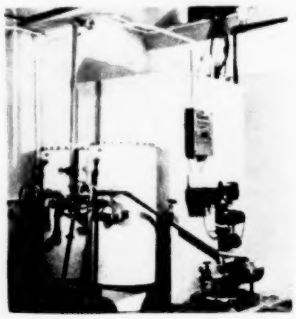
Currently in distribution is Model 21. Less than two feet high, the unit tucks away inconspicuously, and plugs into any standard home current supply for 100% automatic operation in basements, playrooms, storage rooms, beach homes, wherever humidity damage is apt to occur. It produces humidities down to 20% where desired. List price is $149.95. Also available is the deluxe Model 21H, which includes an additional indicator panel, and a humidistat which precisely regulates room humidity to any predetermined level. List price is $179.95.

Adsorption-type dehumidifiers operate on the principle that certain chemicals have an affinity for moisture particles in the air. Air is passed through a bed of the adsorber, is then returned to the room dry and dustfree. After the drying agent becomes saturated, it is electrically and automatically reactivated, and the adsorbed moisture is expelled to the outside in the form of water vapor. There is no liquid water deposited during the process, nor are there any chemicals to replace, so that the operation requires no attention from the housewife at any time.

More Information? Circle Item 25 on postcard, page 131

Package Water Conditioner

Engineered to a high degree of efficiency and simplicity is the completely integrated Permutit package water conditioning plant designed by The Permutit Co., New York, N. Y. These units, without any alterations, may be used: to remove turbidity, color and organic matter from water supplies; to chlorinate: to remove bad tastes and odors; to remove iron and manganese; to neutralize; to soften, and to de-alkalize.



The package plants have many applications among which are to condition water for small municipalities, real estate developments, plantations, ranches and farms, recreational facilities, lumber and logging camps, factories, power stations, railroads, boiler plants, mills, canneries, bottlers, breweries, laundries, ice plants, dairies, etc.

The plant, as a complete package, forms a versatile and self-contained unit which is available in eight standard sizes ranging from 500 to 3,300 gpm and flows of 12,000 to 79,200 gallons per 24 hours.

More Information? Circle Item 26 on postcard, page 131

Small Flow Reducing Valves

New small flow bronze or steel reducing valves for steam, air, gas, or liquid service have been added to the line of Leslie Co., Lyndhurst, N. J. These valves have a wide variety of applications in pilot plant operation, laboratory units, sterilization plants and other fields where small flows have always been a problem.

Compact and rugged, the reducing valves handle inlet pressures to 1,000 psi and reduced pressures from 2 to 400 psi.

Complete capacity tables for four sizes of controlling valves from 3/32 to 5/16 inch are included in Bulletin 511-A to facilitate sizing.

More Information? Circle Item 27 on postcard, page 131

Corrosion Resistant Duct

Corrosion-resistant vent systems and duct work made of Uscolite, a U. S. Rubber product, are being designed and fabricated by Metalwash Machinery Corp., Elizabeth, N. J.

Uscolite is a thermoplastic synthetic rubber-resin composition possessing a combination of structural rigidity, high impact strength, dimensional stability, and chemical resistance.

More Information? Circle Item 28 on postcard, page 131

LAUREL STREET SCHOOL

Rome, New York

STARRETT & VAN VLECK and REGINALD E. MARSH: Associate Architects, New York City; F. D. RICH COMPANY: General Contractor, Stamford, Conn.; HAROLD G. RICE: Supervising Engineer, Rome, New York; A. J. ECKERT CO.: Plumbing Contractor, Albany, New York; H. J. BRANDELES CORP.: Heating Contractor, Utica, New York.

In public buildings such as this, that are built to last, again and again you'll find that in the vital spots copper invariably gets the call over other metals.

There are valid reasons for this. Not another metal or alloy has all of the desirable construction characteristics of copper.

Just check the features of Revere Copper Water Tube outlined in the panel at the right. No wonder there was no hesitation or question when nearly 4 miles of Revere Copper Water Tube was written into the Laurel Street School specifications for plumbing, heating, refrigeration and temperature control lines. And contractors prefer Revere Copper Water Tube because it is not only readily handled and worked, but they know they can trust copper to guard their reputation for quality work. Sizes of tube used in the Laurel Street School ranged from ½ inch to 4 inches.

Keep out of trouble with copper. Specify Revere Copper Water Tube for radiant panel heating, hot and cold water lines, underground service lines, air conditioning and processing lines, and waste stack and vent lines. See the Revere Distributor nearest you today. And, if you have technical problems, he will put you in touch with Revere's Technical Advisory Service.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N.Y.

• • •

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N.Y.— Sales Offices in Principal Cities, Distributors Everywhere.

SEE REVERE'S "MEET THE PRESS" ON NBC TELEVISION, SUNDAYS

WHY REVERE COPPER WATER TUBE IS PREFERRED BY—

Architects, Builders, Plumbing & Heating Contractors

EASY TO BEND

Saves Time

Revere Copper Water Tube is easy to bend. Soft temper can be bent by hand to meet installation conditions.

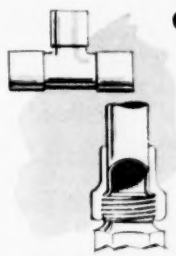
HANDY LENGTHS

Save Fittings . . . Labor

Revere Copper Water Tube comes in straight lengths of 20' in hard and soft tempers. 60' coils of soft temper reduce the number of fittings needed.

SOLDER OR COMPRESSION FITTINGS

Need Less Work Room . . . Save Metal



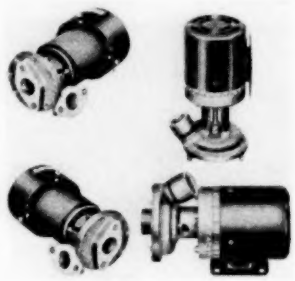
No worry about wrench room when you use Revere Copper Water Tube with solder fittings. Compression fittings can also be used. No threading is necessary with either type fitting. Wall thickness of tube used can thus be less than for threaded pipe.

NON-RUSTING

Rustable pipe eventually clogs as shown in drawing at top right. Non-rustable Revere Copper Water Tube suffers no loss of flow or pressure as shown at bottom right. No allowance in pipe size need be made for rust accumulation with Revere Copper Water Tube.

Small Multi-Purpose Pumps

A line of multi-purpose pumps is introduced by Taco Heaters, Inc., Providence, R. I. These small pumps have wide application and one of their important purposes is to fill the design requirements of the many applications necessary in the original equipment materials field. They can be used as coolant pumps for soluble oil and as pumps for all types of liquids; they have many other applications where it is desired to move water at any temperature up to 210F.

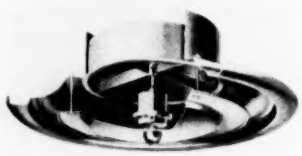


The pumps are available in a variety of specifications and are usually equipped with a bronze body and impeller, stainless steel shaft and specially selected motors ranging from 1/100 to 1/12 hp. The pumps are adaptable and quiet in operation, light in weight and have low operating cost. The pumps are suitable for any operations requiring deliveries up to twenty-two gallons per minute and operations requiring up to twenty-one feet of head.

More Information? Circle Item 29 on postcard, page 131

Thermostat Controls Diffuser

A pneumatic motor, remotely controlled by a thermostat, regulates the movement of the damper and hence air volume in a new modification of its Kno-Draft ceiling diffuser made by Connor Engineering Corp., Danbury, Conn. It is intended for air conditioning systems serving zones having variable heat loads, such as areas subject to changing sun effect, fluctuating occupancy, and office layout revision.



The diffuser is adapted to this type of automatic control of volume at the point of discharge because the sleeve damper moves up and down without enlarging or constricting the neck area. This means that regardless of the damper position performance of the diffuser is unaffected. Air quantity alone is changed, not air pattern or effective area of diffusion.

More Information? Circle Item 30 on postcard, page 131

Gas, Oil Safety Valve

The Valco safety valve, an automatic, temperature-actuated safety shut-off valve for use in all flammable liquid and gas lines, for use in natural gas, gasoline, fuel oil, and flammable solvents lines, is available from Valco, Inc., Cincinnati, Ohio.

This safety valve is a quick closing valve, normally held in the open position by an actuating head that operates like a standard sprinkler head. At the specified temperature, the head opens and releases the tension on a strong stainless steel spring which snaps the valve closed in a fraction of a second.

The valve is packless; it uses a bellows seal to prevent binding and leakage. The bellows is of all metal construction. This type of seal permits rapid inspection and the change of heads without any leakage.

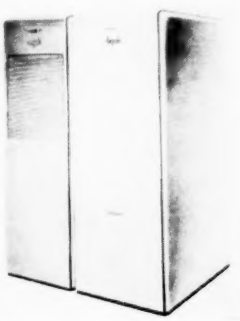
The valve is installed in the line like any other valve and no special tools or training are required. The valve can be mounted in any position, even up-side-down, without affecting its efficiency.

It is supplied in sizes from ½ to 2½ inches and in any specified metal or alloy.

More Information? Circle Item 31 on postcard, page 131

Year Round Twin House Units

New year-round home air conditioning Command-Aire twin units, designed to bring the cost of full-time home comfort within the reach of the average home owner, are introduced by Bryant Heater Div., Affiliated Gas Equipment, Inc., Cleveland, Ohio.



A complete home air conditioning system, the twins may be installed together or, when desired, separately. Installation of the heating unit may be followed at a later date by the addition of the cooling unit without the necessity of adding ducts or making other alterations.

Engineered for both the new and replacement markets, either gas or oil may be burned. Separate blower systems in each of the twin units assure the proper delivery of air for both heating and cooling, provide for better dehumidification control, and prevent overloading the furnace blower.

More Information? Circle Item 32 on postcard, page 131

Cleans Copper Fittings

A copper fitting cleaning tool has been designed by Arcee Products, Pawtucket, R. I., to save time and clean to the bottom of the fitting.

A rubber bonded abrasive is utilized to give the tool longer wear and save labor costs. The abrasive is not only on the outside of the cylinder, but is bonded through the rubber for complete and lasting satisfaction. As the abrasive wears, tighten the wing nut to expand the cylinder.

This new tool for ½ inch fittings always stays to size and abrasive refills are inexpensive and durable.

More Information? Circle Item 33 on postcard, page 131

Gas Schoolroom Heater

An addition to its line of gas heating and air conditioning equipment is a gas forced air schoolroom heater made by Norman Products Co., Columbus, O.

The new heater can be installed along bookshelves or under the window on the outside walls of schools and libraries so that it takes up no space in the room. No duct work required.

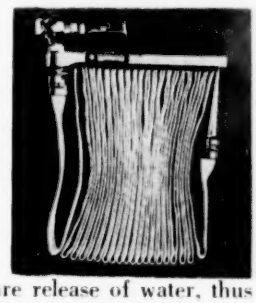
Preheated outside air mixes with room air as it passes through the heater. Flow of air can be adjusted with a damper control. Circulation of warm air from the heater eliminates cold spots in front of windows and prevents excessive drafts and movement of air along floors. The heater draws the circulating room air back through a side return air inlet so that it can mix again with the outside air drawn in by the damper.

The heater is approved by AGA for use with natural, mixed, manufactured or LP gas with capacity of 60,000 Btu input per hr. The unit is enclosed in a heavy gage steel casing. Motor is resiliently mounted for quiet operation and fully enclosed to keep out dust and dirt.

More Information? Circle Item 34 on postcard, page 131

Positive Release Hose Rack

The new Lightning brand fire hose rack has been introduced by American Rubber Mfg. Co., Oakland, Calif. Advantages include:



Positive release of the last fold whether under full water pressure or not. Release pin automatically trips at slight tug to release the last two holding links; hose never hangs upon last fold.

Pressure retaining link holds water in last fold of hose. This same link also prevents premature release of water, thus saves unnecessary damage to interior furnishings.

Spring clip nozzle holder, built into rack to prevent bending or breaking, keeps hose from spilling automatically.

Hose is easy to set up again after use; no tools are required because pressure retaining link does not have to be driven up on wedge plate.

More Information? Circle Item 35 on postcard, page 131

Stainless Steel Pump

Availability of a new type of stainless steel pump is announced by Vanton Pump Corp., New York, N. Y. Incorporating the features of the company's self priming design, which eliminates stuffing boxes, gaskets and internal check valves, the new S series permits pumping of a wide variety of foods and chemicals.

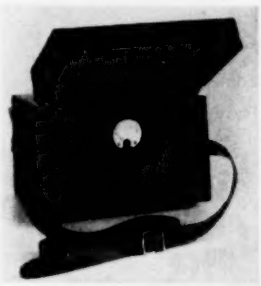
Since the only parts in contact with the fluid are the stainless steel body block and the corrosion resistant precision molded, durable flexible liner, these pumps are particularly adaptable for extreme corrosive service and for the handling of foods or other liquids or slurries where contamination cannot be tolerated. The wide choice of materials in which the flexible liner may be furnished, which includes gum rubber, natural rubber, buna, N, hycar, neoprene, Vinyl, silicone and compar permits the user to select the best material for the application on hand.

The pumps are available in capacity ranges from 1/3 to 20 gpm.

More Information? Circle Item 36 on postcard, page 131

Noise and Sound Analyzer

The Type 420-A sound analyzer, which separates noise, sound and vibration signals into their component frequency bands, is announced by Hermon Hosmer Scott, Inc., Cambridge, Mass. Such frequency analysis is as important as measurement of noise intensity for machinery and blower noise, industrial hygiene, and acoustical contracting applications.



The high and low-pass filters can be independently adjusted in steps of one half octave. A simple interlock permits the pass-band width to be fixed in any multiple of a half octave. The position of this pass-band can then be adjusted throughout the audible range by a single control.

The analyzer is housed in a saddle-leather case and a shoulder strap allows the instrument to be used while the operator is walking about. The analyzer includes a calibrated attenuator, an indicating meter meeting ASA standards, and an output jack for general purpose filter applications. The unit may also be used as an amplifier.

More Information? Circle Item 37 on postcard, page 131

Non-Stick Steam Valve

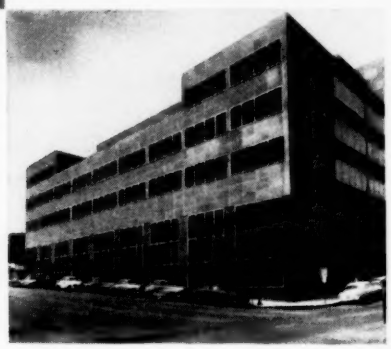
A steam valve offering engineering principles which prevent sticking, a common cause of most steam valve failures, is introduced by Atkomatic Valve Co., Indianapolis, Ind.

Expansion caused by high temperatures combined with deposits of iron oxide, boiler compound, and lime, results in sticking and down-time for maintenance. Engineering principles incorporated in the design now automatically compensate for normal steam valve expansion and deposits, assuring greater valve efficiency, longer valve life, and lower maintenance costs.

More Information? Circle Item 38 on postcard, page 131

(*Continued on page* 126)

Several thermostats, strategically placed, are required to give proper temperature control in the Oregonian's large combination office and lobby area. Honeywell Customized Temperature Control keeps the comfort level just right in all areas, all the time.



Story of Honeywell Customized Temperature Control helps you

Learn about your business– from a publishing plant

Why a customized temperature control system is becoming a "must" for all types of buildings

How do you provide for real comfort if your building is large, has huge areas of glass and is exposed to the elements in all four directions?

And especially, how do you answer this question when your building accommodates such a variety of rooms as offices, press rooms, composing rooms?

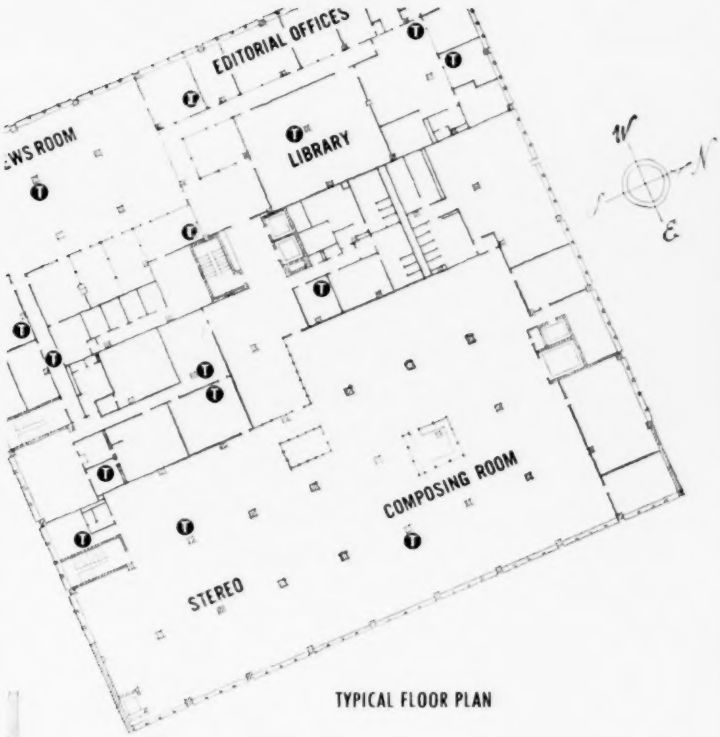
For that matter, how can you be certain temperature control equipment will stand up under 24-hour operation and give the dependable service you can't afford to get along without?

With modification, these major questions which Oregonian officials in Portland, Oregon, and their professional advisers had to answer, can be applied to the businesses of your clients. The answer can be stated in five words: Install Honeywell Customized Temperature Control. This is the answer officials of the Oregonian Publishing Company have found eminently satisfactory. It is the answer for your clients, too.

Key reason why this is so is found in the word *customized*. This means that whatever the control requirements, Honeywell Customized Temperature Control *designed to meet the needs of the building* is your solution. This applies to heating and cooling, ventilation and humidity control.

The customized installation in the case of the Oregonian included careful selection and strategic placement of thermostats as indicated on the floor plan.

Specific problems solved by the Honeywell Customized Temperature Control installation are brought out in the photo captions.



TYPICAL FLOOR PLAN

Several thermostats are necessary in the press room to compensate for heat from the presses themselves—and for solar heat entering through the big windows. Press room employee comfort is also well-guarded by Honeywell Customized Temperature Control.

The comfort problem in the editorial room is quite different. Workers at desks are much less active than press room employees, require a somewhat higher temperature. Loss (or intake) of heat from row of large windows must also be compensated for. But with Honeywell Customized Temperature Control on the job, these problems are easily met—and it's comfortable all the time.

For comfortable, even temperature in new or existing buildings—of any size—use Honeywell Customized Temperature Control

Whether it's an office, airport, hospital, apartment, church, school, factory, store, garage—or any size building—new or existing, Honeywell Customized Temperature Control can help meet your clients' heating, ventilating, air conditioning and industrial control problems.

Once equipped with Honeywell Customized Temperature Control, they'll have an ideal indoor "climate"—and save fuel besides.

For full facts on Honeywell Customized Temperature Control, call your local Honeywell office. There are 104 across the nation. Or mail the coupon today.

Architect of the Oregonian Building was Pietro Belluschi. Mechanical Engineering was by J. Donald Kroeker and Associates.

M. J. Frey, publisher of the Oregonian, says:

"Because of our complex comfort problem we have 110 separate temperature controls in the building. All of these are Honeywell controls. And they all perform in a completely satisfactory manner."

MINNEAPOLIS
Honeywell

First in Controls

MINNEAPOLIS-HONEYWELL REGULATOR CO.
Dept. HV-9-177 Minneapolis 8, Minnesota

Gentlemen:
I'm interested in learning more about Honeywell Customized Temperature Control.

Name .....

Firm Name .....

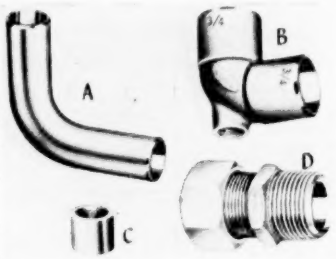
Address .....

City ..... *Zone* ..... *State* .....

(*Continued from page* 123)

Baseboard Radiator Fittings

A line of fittings specially designed for baseboard heating installations is announced by Northern Indiana Brass Co., Elkhart, Ind.



These fittings include a baseboard tee (*B*) with a ⅛-inch female connection on one end to accommodate an automatic air vent. These tees approximate the elbow in design, thereby providing a very short roughing-in dimension to allow installation in narrow baseboard units. Another item is a ½ × ⅛ inch female flush bushing (*C*) for converting standard solder joint tees for baseboard usage.

Also, shown in *A* is a new wrought copper baseboard 90° elbow for which compression-to-male adapters *D* can be furnished. This combination is used effectively to join baseboard units close-coupled at the corners.

More Information? Circle Item 39 on postcard, page 131

Vertical Delivery Unit Heater

A new and improved line of vertical delivery unit heaters for steam and hot water is announced by Modine Mfg. Co., Racine, Wis. A feature of the new line is the light weight which has been achieved without sacrificing any structural strength or durability. The largest model, having a capacity of 600,500 Btu per hr. weighs only 284 lb. The advantage of this light weight is ease of handling during installation and elimination of structural ceiling supports required for mounting heavier unit heaters.

Departing from a square casing design and flat heating coil, the units feature circular casings and coils. Performance has been improved by increased heat transfer capacity as related to motor horsepower and by stepped-up air volume and velocity. Outlet air temperatures have been retained in the 110 to 120 deg. range for maximum comfort and fuel economy. The new line is offered in twenty-six different models including thirteen for normal steam pressures and thirteen with lower outlet temperatures for high pressure steam. A choice of five different types of air deflectors, optional at extra charge, is available.

More Information? Circle Item 40 on postcard, page 131

Automatic Shut-Off Valves

Eight new and improved basic models of its automatic shut-off valves are announced by Security Valve Corp., Los Angeles, Calif. They are recommended for use on gas or fluid lines where automatic shut-off is required.

The valves will provide automatic shut-off in the event of either increase or decrease in pressure. Installation may be upstream or downstream in relation to the regulator, with or without static line control, for either high or low pressure application.

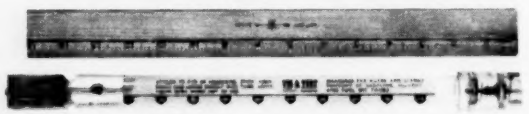
The design provides for installation in existing pipe lines with negligible pressure drop. Model HDPS-L (closes on increase or decrease of pressure, static line control, low pressure application) is illustrated.

The valves are available in either cast iron or steel.

More Information? Circle Item 41 on postcard, page 131

Samples Bottom of Oil Tank

The Visa-Test gage, which is fastened permanently to the end of the standard liquid storage tank measuring stick to obtain an exact sample of the bottom content of the tank, is introduced by Visa-Test Sales Co., Burlingame, Calif.



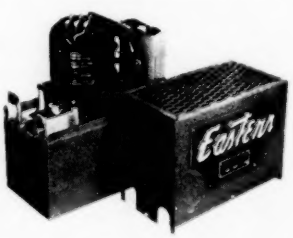
The gage shows an accurate cross-section measurement of the water, sludge, and other foreign matter which may be drawn by the suction line. Trip valve closes upon contact with bottom of tank, permitting sample to be raised and examined.

Component parts are not affected by any petroleum product. Measurement tape in tube is printed in white plastic and coated with clear plastic preventing discoloration or fading.

More Information? Circle Item 42 on postcard, page 131

Condensate Disposal Unit

A new condensate disposal unit is announced by Eastern Industries, Inc., New Haven, Conn. This Model 3 Type 100 unit is completely automatic with mercury switch and is designed to remove hot or cold condensate fluids from the brass receiver tank and pump it to an outside drain. Simple to install in air conditioning units, it gives quiet, reliable performance with low operating cost. It is rust proof.



The unit has a heavy duty ball bearing induction type motor. It measures 5⅛ inches wide, 10 inches long, 11¾ inches high, weighs 23 pounds.

More Information? Circle Item 43 on postcard, page 131

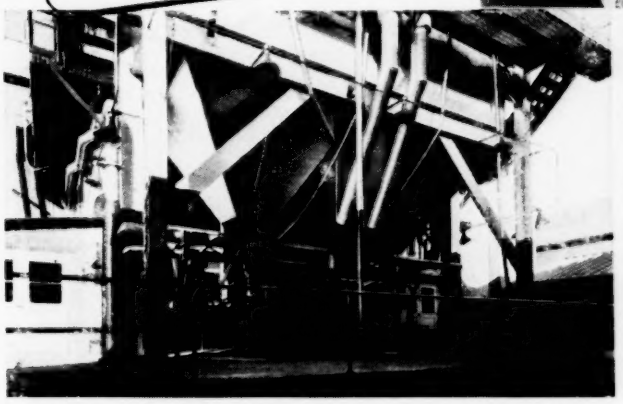
(*Continued on page* 128)

"We modernized our plant, installed new COAL-burning equipment, AND CUT OUR FUEL COSTS 45%!"

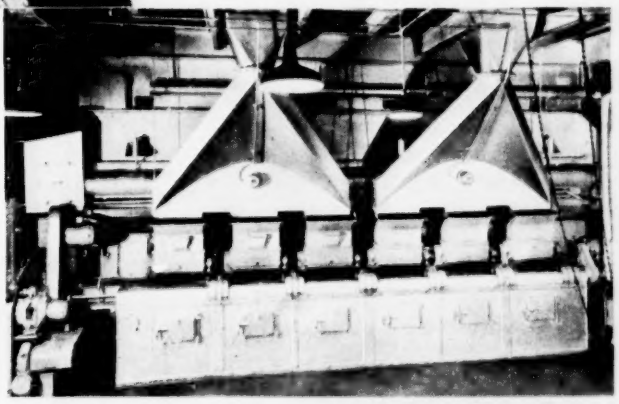
says MR. A. J. GOETZ, Executive Vice President, River Raisin Paper Co., Monroe, Michigan.

"We recently modernized our entire plant following an extensive engineering survey. New coal-burning and coal-handling equipment was installed . . . heat losses were reduced . . . efficiency raised. As a result, our fuel costs have been cut 45 to 50%—proving to us that you just can't beat bituminous coal burned the modern way."

"In Addition, Automatic Coal- and Ash-Handling Equipment Cuts Labor Costs 60%!"



This view shows how River Raisin has installed its modern fly-ash reinjection system at the rear of the boilers but outside the plant. The plant also features outdoor coal handling to save additional interior space.



"We chose these modern spreader stokers for their advantages of low maintenance, low power requirements, and their ability to meet fairly rapid load changes. They give us maximum efficiency under all operating conditions."

Modernizing your present plant? Building a new one? In either case let a consulting engineer show you exactly how you can meet your *specific* needs with a modern coal installation—and at the same time save more money than you thought possible.

Automatic coal- and ash-handling equipment can cut your labor costs to a minimum. And, today, with a modern combustion installation, you can actually get 10 to 40% more power from each ton of coal than was possible a few years ago.

Moreover, with coal you'll never have to worry about a shortage of fuel. America's coal reserves are virtually inexhaustible, and this coal is mined by one of America's most efficient and productive industries. This means that coal users—unlike those committed to other fuels—get the advantage of dependable future supply as well as more stable prices.

If you operate a steam plant, you can't afford to ignore these facts!

COAL in most places is today's lowest-cost fuel.

COAL resources in America are adequate for all needs—*for hundreds of years to come.*

COAL production in the U. S. A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

BITUMINOUS COAL INSTITUTE

A Department of National Coal Association, Washington, D. C.

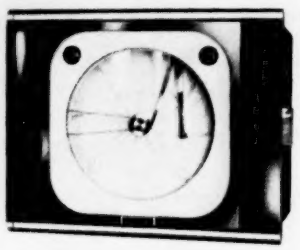
FOR HIGH EFFICIENCY FOR LOW COST

YOU CAN COUNT ON COAL!

(*Continued from page 126*)

New Program Controllers

Electronic Dynamaster recording potentiometers are now available in the form of time-temperature program controllers, according to The Bristol Co., Waterbury, Conn. These program controllers regulate temperature according to a predetermined schedule of changing values. Any desired program, such as a heating or cooling cycle can be accurately maintained.

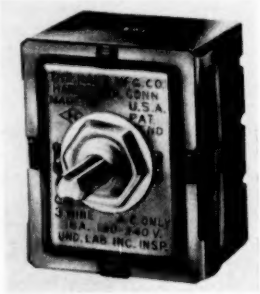


The desired schedule of temperatures is prescribed by the contour of a transparent plastic cam. The same controller can be used to maintain any number of different temperature programs, since cams of different contour are easily cut and interchanged. The instruments employ an electronic control system with proportional input action optionally available.

More Information? Circle Item 44 on postcard, page 131

Motor Reversing Switch

A small new motor reversing switch of compact design, and featuring a fast and simple connection method, is announced by The Hart Mfg. Co., Hartford, Conn.



A two-pole motor reversing switch with ratings of 1 hp at 120 volts, 2 hp at 240 volts, A.C., this Diamond H model, one of the 850 Series, is designed for air conditioners and similar applications involving a single-phase motor whose direction must be reversed.

Auto-lock connections provide instant, positive hook-up, without binding screws or extra clips, by simply pushing the stripped end of standard wire, solid or stranded, into the connection. Depressing a small lever gives instant release.

More Information? Circle Item 45 on postcard, page 131

Tubing Test Plug

Test plugs to shut off the end of a tube temporarily, are announced by The Imperial Brass Mfg. Co., Chicago, Ill.

These plugs are said to be specially convenient for use in instrumentation, radiant heat, refrigeration, LP gas, and similar installations. They make it possible to test tubing installations before they are put into service or when trouble shooting for leaks.

Plug is inserted in end of tube and wing nut is tightened. This expands synthetic rubber portion of plug and seals tube. It is stated that these plugs will hold pressures up to 100 lbs and can be used on all liquid or gas tubing lines except those where material conveyed would deteriorate synthetic rubber. Plugs are available in five sizes: ¼, ⅜, ½, ⅝ and ¾ inch O.D.

Bulletin 111-REF is available.

More Information? Circle Item 46 on postcard, page 131

Finds Refrigerant Leaks

A leak detector stem which enables servicemen to locate leaks of non-combustible halide refrigerant gases quickly and accurately, even when the leaks are as small as 20 parts of gas in a million parts of air, is introduced by Linde Air Products Co., a Div. of Union Carbide and Carbon Corp., New York, N. Y. The detector stem employs a small acetylene flame which reacts instantly to such gases as F-11, F-12, F-21, F-113, F-114, and Carrene; or to methyl bromide vapors in air, where such concentrations are less than 10%.

A 3-ft long suction hose probes easily into hard-to-reach spots and draws escaping gas to the special alloy reaction plate, where any trace of refrigerant gas causes a distinct color change in the flame. Because of the sensitivity of the reaction plate and the flexibility of the suction hose, it is easy to pin-point the source of a leak rapidly. A stainless steel mixed tube and a ceramic insulating sleeve prevent overheating of the handle during operation.

More Information? Circle Item 47 on postcard, page 131

114 lb. Portable Heater

A complete heating unit with the capacity of an average furnace and the dimensions of an orange crate is the Model E-600 Heater, a product of Perfection Stove Co., Cleveland, Ohio. It has a capacity of 60,000 Btu per hour, weighs 114 pounds, including the fuel for five hours service, and can easily be carried by two men.

This heater is completely self-contained, including a centrifugal pressure-type dual blower. It can be operated from 110 volts AC or 24 volts DC.

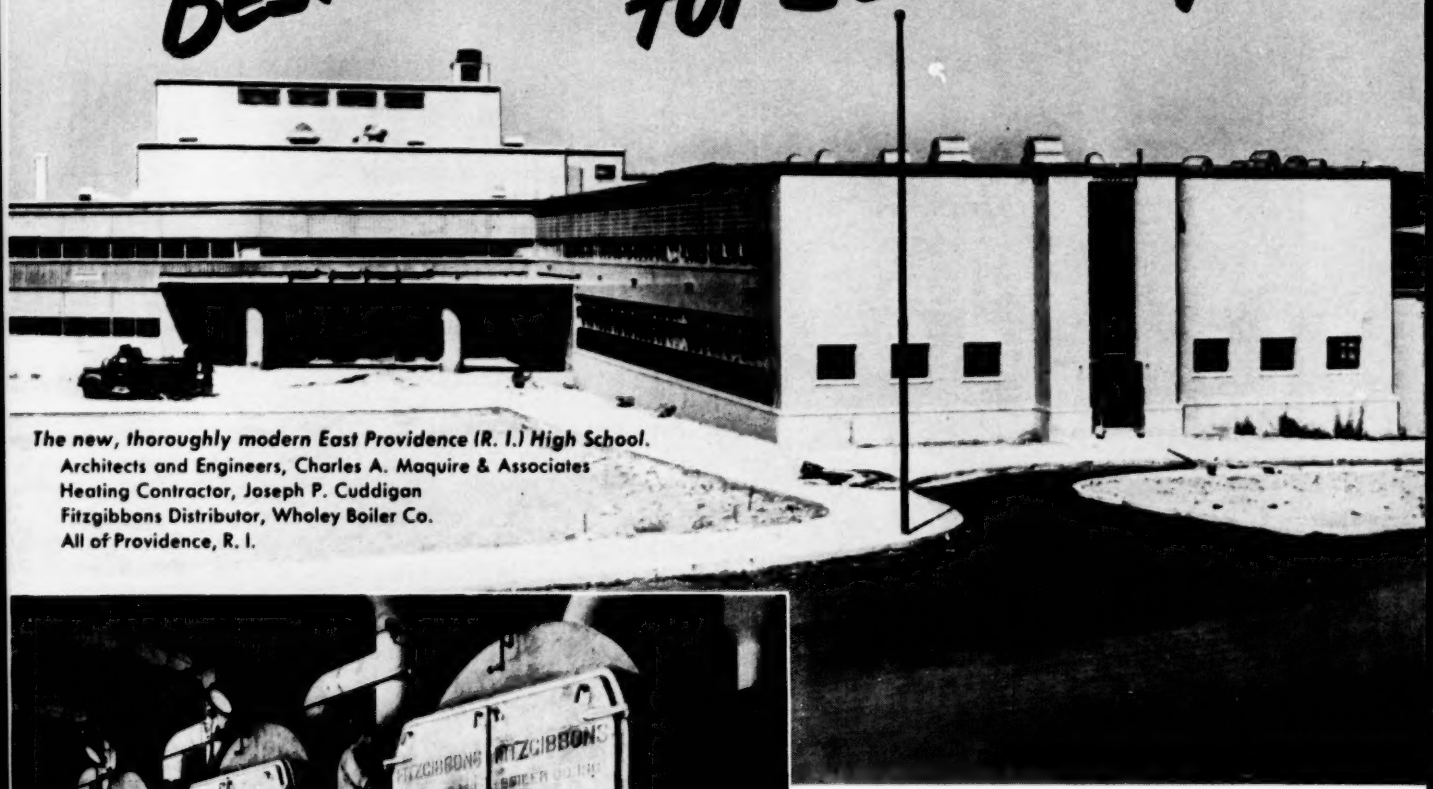
The unit burns fuel oil or gasoline. Positive ignition is assured by a glow plug that vaporizes as well as ignites the fuel. A single operating switch provides convenient manual high-low operation.

More Information? Circle Item 48 on postcard, page 131

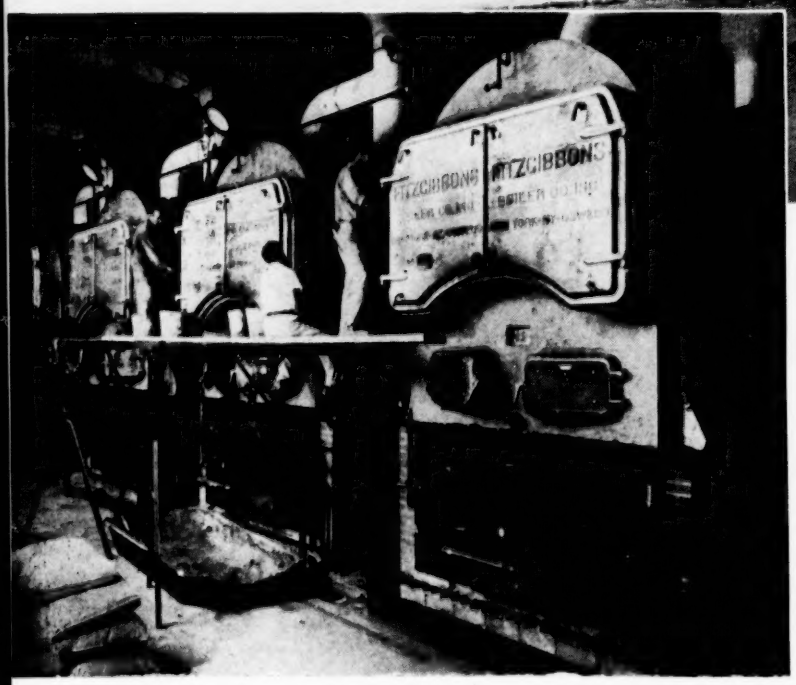
Now...set fastening studs wherever they're needed
MODEL 450 REMINGTON STUD DRIVER
Here's new economy . . . new speed in construction fastening! The Remington Stud Driver joins wood or steel sections to concrete or steel surfaces in seconds . . . easily sets as high as 5 studs a minute. Powerful 32 caliber charges drive studs arrow-straight. The tool's light weight—only 5½ pounds—simplifies handling wherever studs are needed.
New guards for specific uses now make the self-powered Remington Stud Driver more versatile than ever. These attachments take all the guesswork out of stud location . . . assure fast, accurate fastening for every job. Illustrated are just 4 of these special guards. For full information about the complete line and about the Remington Stud Driver, send the coupon below.
A complete line of guards for special applications
Guard for Structural Channel
Guard for Switch, Utility and Outlet Boxes
Guard for "Unistrut" Sections
Guard for Conduit Clips
Listed & Approved by Underwriters' Laboratories, Inc.
MAIL THIS COUPON TODAY
Industrial Sales Division, Dept. HV-9
Remington Arms Company, Inc.
939 Barnum Ave., Bridgeport 2, Connecticut
Please send me my free copies of the new booklets showing how I can cut my fastening costs.
Name
Position
Firm
Address
City State
"If It's Remington—It's Right!"
Remington
DUPONT

THE FITZGIBBONS BOILER®

Best Boiler Buy for SCHOOLS!



The new, thoroughly modern East Providence (R. I.) High School.
Architects and Engineers, Charles A. Maguire & Associates
Heating Contractor, Joseph P. Cuddigan
Fitzgibbons Distributor, Wholey Boiler Co.
All of Providence, R. I.



Here are the four Fitzgibbons "D" Type boilers, each one rated for 30,360 sq. ft. steam, in the East Providence High School. The photo shows lagging being applied. "D" Type boilers are available in sizes from 3650 sq. ft. steam, to 42,500 sq. ft. E.D.R. rating (S.B.I.) Types for oil, gas, stoker and hand fired coal. Full specifications and data in the "D" Type Bulletin, on request.

HERE IS ANOTHER of the many up-to-the-minute schools that enjoy the economy and abundant heating comfort of Fitzgibbons Steel boilers. Four Fitzgibbons "D" Type boilers handle the heating job with ease in the most severe New England winter, and do it with the outstanding fuel savings for which these boilers are famed in schools, colleges, and institutional buildings throughout the nation. School boards everywhere have learned that "the best boiler buy is Fitzgibbons."

SINCE 1886 MOST ECONOMICAL IN FUEL THE FITZGIBBONS BOILER 1886

Fitzgibbons Boiler Company, Inc. SBI

General Offices: 101 PARK AVENUE, NEW YORK 17, N. Y.
Manufactured at OSWEGO, N. Y. • *Branches in Principal Cities*

PRODUCT INFORMATION SERVICE

Use the postage-free postcard below for further information on:

- **News of Equipment and Materials**

or a copy of the following

- **New Catalogs**

Circle the item Numbers in which you are interested and print clearly your name and address with title.

NEW CATALOGS

WEATHERPROOF MOTORS
Bulletin WP-1 on its weather-protected motors has been issued by Howell Electric Motors Co., Howell, Mich. These motors are designed to give smooth running performance under all outdoor conditions. Descriptions, illustrations and dimensional data are included. . . . . **Item 49**

FREON CONDENSERS
A four-page bulletin is available from Doyle & Roth Mfg. Co., Inc., Brooklyn, N. Y., on its line of Model DRS Freon condensers. . . . . **Item 50**

FLEXIBLE METAL HOSE
Bulletin No. 15-D on flexible metal hose has been issued by Atlantic Metal Hose Co., Inc., New York, N. Y. It contains illustrations of the company's line of high pressure interlocking bronze and steel flexible hose, tar and asphalt hose, loading and unloading and necessary couplings. The bulletin lists all current applications and provides full test and engineering data. . . . . **Item 51**

HEAT CURTAINS
Bulletin 560-61 of the Heating Dept., Dravo Corp., Pittsburgh, Pa., illustrates how a heat curtain was designed to solve the problem of cold air inrushing through open doors. The four-page booklet also explains how two combination oil and gas fired space heaters were equipped with ductwork to heat a 23,400 sq ft metal working plant. Duct system is arranged so that one heater can carry the load in mild weather. . . . . **Item 52**

GAS-OIL BURNERS
Bulletin R-230 has been issued by Eclipse Fuel Engineering Co., Rockford, Ill., describing that company's series CF closed flame gas-oil burners. . . . . **Item 53**

STONE LINED TANK
A bulletin illustrating the important new features of its Super-Stone lined water tank is available from Factory Distributors, Inc., Pittsburgh, Pa. It covers construction features, testing procedure, the company's 20 year guarantee, and the stone lining feature. . . . . **Item 54**

SILVER SOLDERING PIPE
A four-page folder entitled, Low Temperature Brazing News No. 61, is available from Handy & Harman, New York, N. Y., featuring the use of silver brazed thin-walled tubing in the plumbing for two large New York housing projects. Also included is information on other applications of silver brazing. . . . . **Item 55**

VENTILATING FANS
An 18-page bulletin on its line of Rex-Airate domestic, commercial and industrial ventilating fans is introduced by Air Controls, Inc., Division of Cleveland Heater Co., Cleveland, Ohio. Descriptive and application data are given on the company's window fans, attic fans, and other types of axial flow fans, together with its ceiling shutters, penthouses and automatic shutters. . . . . **Item 56**

TUBE FITTINGS AND TOOLS
Catalog 621 covering tube fittings and shut-off valves, brass pipe fittings and tubing tools for plumbing, heating, oil burner, LP gas and city gas applications, is issued by The Imperial Brass Mfg Co., Chicago, Ill. Among the new items shown in this catalog are heavy duty, lever-type tube benders for various combinations of tubing sizes, gear-type tube benders for bending either hard or soft drawn tubing and a slide-to-size tube cutter for cutting large sizes of tubing. The catalog includes Kwik-Tite compression fittings and flared tube fittings and describes convenient cabinet stocks of fittings. It has information on the Rol-Air flaring tool which both flares and burnishes tubing. . . . . **Item 57**

WATER AND WATER HEATERS
Facts About Hot Water is the title of a 20-page booklet published by Sellers Engineering Co., Chicago, Ill., and devoted to the subject of water rather than to the company's products. It explains, in a most readable way, ground water, water supply, surface water, water characteristics, corrosion from water, and the heating of hard and soft water, followed by a classification of different kinds of water heaters including how to heat water to two temperatures. Also covered is the classification sheet for selecting water heaters. . . . . **Item 58**

OIL BOILER-BURNER
A 4-page folder describing the company's boiler-burner unit is available from C. Hoffberger Co., Baltimore, Md. Unit is available in sixteen sizes of up to 1600 hp. output, oil-fired to use any grade fuel oil. . . . . **Item 59**

SPREADER STOKERS
Form 2530, a 12-page catalog in four colors giving full information on its pneumatic spreader stokers, for bituminous, sub-bituminous, high ash fusion, and lignite coals, is issued by Iron Fireman Mfg. Co., Cleveland, Ohio. Text covers coal conveying, drying and pre-heating, and automatic firing. Material on automatic combustion controls, dumping grates, and fly ash system included. . . . . **Item 60**

COMBUSTIBLE GAS ALARM
Scanning type multi-point J-W combustible gas alarms for industrial protection are described in Form RV453 published by Johnson-Williams, Ltd., Palo Alto, Calif. This publication illustrates and describes indicating and recording instruments in standard and explosion-proof styles. Detail is provided on the means by which samples are continuously drawn to the analyzer unit from remote points and measured for combustibility on a 30-second cycle. . . . . **Item 61**

SMALL COOLING TOWER
A bulletin describing all features, data and dimensions of its Thrifti-Tower, small cooling tower for commercial and residential air conditioning systems, is published by Marlo Coil Co., St. Louis, Mo. Bulletin covers performance characteristics, and includes a data and dimension chart giving pump sizes, water flow, motor horsepower, shipping weight and dimensions on units ranging in size from 2 to 16 tons. . . . . **Item 62**

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PUMP MOTORS

Bulletin 1250 covering its line of hollow and solid shaft vertical pump motors is issued by The Louis Allis Co., Milwaukee, Wis. It shows the various types of enclosures available for these units and illustrates many varied uses for these motors in industry. Several four-color cutaway illustrations and phantom drawings also show details of the non-reverse ratchet, types of oil- and grease-lubricated thrust-bearings available, and specific features of motor construction. . . **Item 63**

ROOF AND WALL EXHAUSTERS

Bulletin 53B, devoted to its line of power exhausters, is issued by Jenn-Air Products Co., Inc., Indianapolis, Ind. The company's line includes roof exhausters of two types as well as a centrifugal wall exhauster, popular for spot ventilating applications. Back draft eliminators and ring-type grilles described. . . . . **Item 64**

INSULATING METAL BUILDINGS

Insulation of metal buildings with superfine blanket form of fiberglass is the subject of Folder F-9 issued by Fiber Glass Div., Libbey-Owens-Ford Glass Co., Toledo, Ohio. It shows pictorially three standard methods for applying the insulation for combined heat and noise control to industrial and commercial structures depending upon the requirements and functions desired, and gives a data chart for use of architects, engineers and technicians, charts on sound absorbtion, and data on thermal conductivity. . . . **Item 65**

DUAL PURPOSE COUPLING

Folder 101 describing the new Dual-Purpose coupling repair clamp is available from Morris Coupling and Clamp Co., Ellwood City, Pa. It explains application of the device for the coupling or repair of gas, water and petroleum pipe lines. Complete price and specification data are included, and the 6-step method of assembly illustrates simplicity of design, speed of installation, and durability of the components. . . . . **Item 66**

WELDED FLOATS

An 8-page bulletin No. 753, featuring welded floats of stainless steel, monel and chrome plated steel, in spherical, elliptical and cylindrical shapes with price list, weights, buoyancies and collapsing pressures, as well as other useful information, is issued by W. H. Nicholson & Co., Wilkes-Barre, Pa. . . . . **Item 67**

INDUSTRIAL THERMOMETERS

Bulletin E-2, a new catalog in which both mercury-in-glass and bimetallic industrial thermometers are featured, is issued by Precision Thermometer & Instrument Co., Philadelphia, Pa. . . **Item 68**

AIR ELIMINATORS

A series of data sheets is available from Gorton Heating Corp., Cranford, N. J., and covering that company's line of vapor equalizing valves and air eliminators for steam systems. . . . . **Item 69**

OIL BURNERS

A condensed 16 page catalog listing commercial and industrial oil and combination gas-oil burners, including fully automatic, semi-automatic and manually controlled horizontal rotary and steam turbine drive burners; commercial and domestic pressure atomizing types for oil, gas or combination gas-oil, giving specifications and capacities, is issued by Ray Oil Burner Co., San Francisco. . . . **Item 70**

DOES AIR CONDITIONING PAY?

Does It Pay to Air Condition Your Plant? is the title of a four page reprint of an article based on the experience of The Rotor Tool Co., Cleveland, Ohio, and issued by that company as a service to those interested in air conditioning particularly for industrial plants. It is of particular interest to sales engineers selling air conditioning to industrial prospects since the results are those reported by the owner of the plant. . . . . **Item 71**

NON-CORROSIVE DRAIN PIPE

A four-page folder has been issued by The Duriron Co., Inc., Dayton, Ohio, describing its corrosion resisting drain pipe and fittings. Fittings are described and illustrated and accompanied by company instructions on installing. . . . . **Item 72**

PSYCHROMETRIC THERMOMETERS

A four-page catalog, No. 12-A-20 describing installation and application of pairs of fluid-filled temperature elements for indicating and recording relative humidity, is available from Fischer & Porter Co., Hatboro, Pa. Advising on installation of natural circulation, blower circulated, and porous sleeve psychrometers for both open and closed systems, the catalog includes a psychrometric table for use in interpreting dry and wet bulb readings to values of relative humidity. . . . . **Item 73**

FAN ENGINEERING MANUAL

A 64-page, illustrated axial-flow fan catalog No. 20 is issued by Aerovent Fan Company, Inc., Piqua, Ohio. Engineering, installation and operating data for all standard and special-duty fan applications. Pertinent details for calculating duct sizes, friction losses, performance and horsepower requirements. Full details and description of fans and accessory equipment. . . . . **Item 74**

MEASURING EQUIPMENT

A revised edition of its 64-page measuring equipment catalog, containing information on more than 115 testing and measuring devices for laboratory and production line use, is available from General Electric Co., Schenectady, N. Y. The publication, GEC-1016A, contains information on products ranging from simple current indicators to completely automatic oscillographs; from surface roughness scales to mass spectrometers and d-c amplifiers. . . . . **Item 75**

GENERAL PURPOSE PUMP

A catalog sheet, Form 2531, illustrating features of the company's recently-introduced general purpose pump for industry, farm and home use is issued by Hypro Engineering, Inc., Minneapolis, Minn. The two-color literature describes specifications of the new pump, shows performance tables for each pump size, illustrates applications of the pump and of various drive assemblies. . . . . **Item 76**

PIPING HEAT LOSS DATA SHEET

A four-page heat loss estimate sheet, for preparing analyses of thermal insulation for piping, heated industrial equipment and similar work, has been revised by Industrial Mineral Fiber Institute, Inc., New York, N. Y. The 10½ x 16-inch tabular estimate sheet is supplemented by four reference graphs and tables which aid the insulation engineer and specifier in determining heat losses from either flat surfaces or piping and in selecting optimum insulation thickness. Step-by-step instructions are given for recording survey data for each type of heated surface and for obtaining the required calculated data. Copies of the sheet may be obtained at 30 cents a doz. . . . . **Item 77**

WATER HEATER, ACCESSORIES

Just issued is Catalog 53 of Sands Mfg. Co., Cleveland, Ohio, describing its complete line of automatic gas storage water heaters and side-arm water heaters. Also included are coils, relief valves and other accessories for both automatic and side-arm heaters. Specifications of each type are given to make ordering easy. In addition, helpful installation diagrams are shown both for the automatic and side-arm types. . . . . **Item 78**

HOT WATER SPECIALTIES

Catalog H-199, a general catalog on its heating specialties, is available from Taco Heaters, Inc., Providence, R. I. It features convenient and simple circulator performance curves, simple heater selection charts and complete information on all the company's heating specialties and accessories. . . . . **Item 79**

SPECIAL SCAFFOLDING

Form DF-1, describing specifications and uses of its new demountable end frame for special scaffolding applications is issued by Waco Mfg. Co., Minneapolis, Minn. Designed to pass through narrow openings in boilers, water tanks and into other confined spaces where conventional scaffolding must be ruled out, the new frame is available in widths varying from 3 to 5 feet. It incorporates exclusive features, including Speedlock assembly, built-in coupling pins and pivoted cross braces. . . . . **Item 80**

PLASTIC PIPE

An informative eight-page brochure entitled "Facts You Should Know About Plastic Pipe," has been issued by Waljohn Plastics, Inc., Brooklyn, N. Y. Advantages, differences, applications, and considerable other information regarding plastic pipe are included. . . . . **Item 81**

PLEASE SEND US MORE INFORMATION. Circle below item numbers on which you wish further information.

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11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
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The Plaza, like 91% of the hundreds of other buildings that make up the New York skyline, has complete **p-k** heat exchange equipment—instantaneous hot water heaters, storage water heaters, and condensate coolers.

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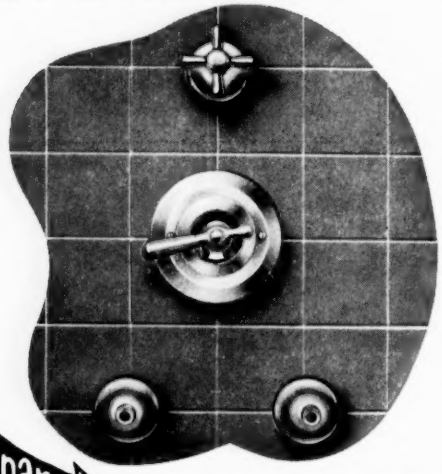
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NEWS OF THE MONTH

EQUIPMENT SALES

in air-conditioning and refrigeration hold even while self-contained units spurt up 42% to $133 million.

Shipments of components and accessories for air-conditioning and refrigeration equipment in 1952 were valued at $213 million, representing no change from the previous year, according to the Bureau of the Census, Department of Commerce. Shipments of condensing units in 1952 totaled 698 thousand, valued at $65 million, compared with 840 thousand units valued at $76 million in 1951. A total of 1,677,300 compressors and compressor units, valued at $71 million, were shipped in 1952. This represents increases of 59% in number and 25% in value compared with 1951. The value of heat-exchanger equipment shipped in 1952 amounted to $63 million, down slightly from the previous year, and shipments of centrifugal refrigeration systems, at $14.0 million, showed a decrease of $1.3 million from 1951.

• **UNITS.**—Shipments of self-contained air-conditioning units totaled 424,105 valued at $133 million in 1952, up 50% and 42%, respectively, over number of units and value in 1951.

Table 1 presents a summary of the quantity and value of shipments of air-conditioning and refrigeration equipment by class of product for 1951 and 1952.

• **SCOPE.**—The figures on quantity and value of shipments in the Bureau report represent completed sales of equipment, *i.e.*, units actually billed and shipped. Complete units delivered on consignment or shipped to a branch warehouse for stock are not included until such time as they are actually sold. The dollar values shown are the manufacturers' net billing prices, f.o.b. factory.

Bureau release M52A-02 presents data for five years and for all known companies manufacturing components and accessories for air-conditioning and commercial refrigeration and complete air-conditioning equipment of the types specified. The 1952 figures are based on reports received from 128 companies. Any inquiries concerning these data should be addressed to the Bureau of the Census, Industry Division, Metals and Metal Products Section, Washington 25, D. C.

• **1953.**—Manufacturers' shipments of room air conditioners for the first half of 1953 indicate *an increase of 215%* over the same period of 1952, according to figures of the Air-Conditioning and Refrigeration Institute of Washington, D. C. At this rate, 1953 shipments will exceed one million units compared with 365,451 units for 1952. (Note that figures in Table 1 for self contained units other than window-sill type include 8,345 "room air conditioners" of 1.5 hp or less, valued at $3.6 million.)

Acceptance of the room air conditioner by the public as a means of greater comfort, health, and efficiency in the home, plus its ready adaptability to small offices and shops is reflected by the fact that the increase in ship-

(*Continued on page* 134)

Did YOU send for your copy?
IT TELLS HOW TO BRAZE PIPE and TUBING
INSTRUCTIONS FOR BRAZING FITTINGS TO PIPE AND TUBING WITH EASY-FLO and SIL-FOS

Here in clear, concise form is the step-by-step procedure for joining ferrous and non-ferrous pipe and tubing with the fast, reliable, economical low-temperature silver brazing alloys EASY-FLO and SIL-FOS. It tells how to—cut and fit—clean—flux—support assemblies—heat and flow the alloys—clean after brazing. Write for a copy now.

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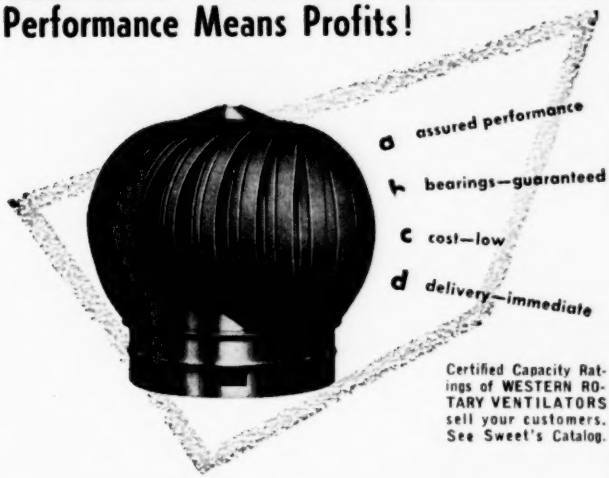

Certified Capacity Ratings of WESTERN ROTARY VENTILATORS sell your customers. See Sweet's Catalog.

Remember—you can't look at a ventilator and judge its value. Western Rotary Ventilators have been thoroughly tested and results published. Check Sweet's, A.E.C. or write for catalog. Features life-time guaranteed bearings—enduring metallic finish on durable galvanized steel. Throat sizes 6" thru 48". Order from your local dealer. **The complete line of Western ventilating equipment is handled by wholesalers coast to coast.**

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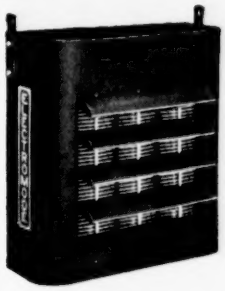
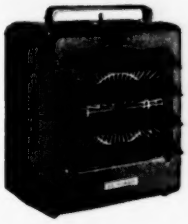
Now is the time to Solve Next Winter's HEATING PROBLEMS



MODEL 14-10

Suspension Type Models, 10,000 to 45,000 watts. For permanent installation where large areas are to be heated and for auxiliary heat in hard-to-heat areas. Adjustable louvers for directing fan-circulated heat where desired.



MODEL AN-30A

Combination Portable and Suspension Type Models, 1500 to 7500 watts. Smaller heaters may be plugged in temporarily wherever heat is needed or mounted permanently on swivel-type brackets. Adjustable louvers for directing fan-circulated heat where desired.

Plan now for

WINTER COMFORT

with

ELECTROMODE

All-Electric

UNIT HEATERS

Models and Capacities To Match Requirements

PLANT • OFFICE WAREHOUSE

- Quick, Easy Installation
- No Plumbing Required
- No Wasted Heat
- Satisfied Users
- Nothing to Freeze
- For Utmost Economy can be thermostatically controlled

Completely SAFE!

Only Electromode has the sealed-in CAST-ALUMINUM HEATING ELEMENT. No danger of fire, shock or burn. Automatic safety switch prevents overheating.

Approved by Underwriters' Laboratories

For HOMES • OFFICES MOTELS • STORES

This modern design Electromode Wall-Type Heater has built-in thermostat for individual room temperature control. Fan-circulated heat is distributed by Down-Flo principle—at floor level. Easy to install in new building or remodeling. Handsome silver grey hammertone finish. Available in 1500 to 4000 watts.

MODEL WA

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☐ Electromode Industrial Heaters

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greater efficiency for

Commercial and Industrial

GAS

fired heating plants with

field

"M-G" draft controls

1. Double acting gate opens inward to regulate up-drafts and outward to relieve down-drafts.
2. Adding or taking off weights provide simple adjustment for up-draft conditions at time of installation.
3. Control will relieve internal or down-draft pressures of only a few thousandths of an inch.
4. Weights attached to gate itself are factory set to insure extreme sensitivity to down-draft conditions.
5. Corrosion resistant knife edge bearings resting on self-aligning bearing plates assure extreme sensitivity yet long life.
6. Side wings improve the regulation, making the control accurate at all gate positions.
7. Long collar keeps gate out of the path of flue gases—resulting in greatly increased life.

Now there is a Field Draft Control to provide for commercial gas-fired heating plants the same accurate, dependable, fuel-saving performance that has made Field first choice for oil and coal furnaces. The new Field "M-G" for gas is fully proven, widely accepted, fully safe — a control specially designed for gas but retaining all outstanding design features of the Field Type M Control. Write today for complete information.

FIELD CONTROL DIVISION

of H. D. Conkey & Company — Mendota, Illinois

AFFILIATES: Conco Building Products, Inc.—Brick, Tile, Stone
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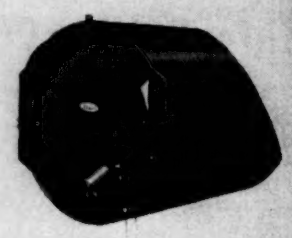
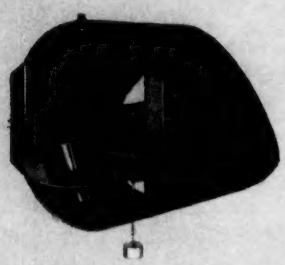
UP-DRAFT VIEW

Gate opens inward to regulate updrafts in conventional, proven manner, checking any excess in draft.





DOWN-DRAFT VIEW

Gate opens outward to relieve down drafts which might affect flame. An optional safety switch closes main gas valve in case of prolonged down draft, thus providing full protection.

(Continued from page 132)

TABLE 1.—AIR-CONDITIONING EQUIPMENT AND COMPONENTS AND ACCESSORIES FOR AIR-CONDITIONING AND REFRIGERATION EQUIPMENT: QUANTITY AND VALUE OF SHIPMENTS, BY CLASS OF PRODUCT, 1948-1952

(Value figures in thousands of dollars)

Class of product	1952		1951	
	Number	Value	Number	Value
Condensing units, total	698,473	$64,834	840,176	$75,672
Ammonia refrigerants	209	300	240	404
Refrigerants (except ammonia), total	698,264	64,534	839,936	75,268
Air-cooled	659,441	50,541	796,303	58,624
Water-cooled	38,823	13,993	43,633	16,644
Compressors and compressor units, total	1,677,300	71,047	1,051,937	56,669
Ammonia refrigerants	1,825	4,708	2,401	6,465
Refrigerants (except ammonia)	1,675,475	66,339	1,049,536	50,204
Heat-exchanger equipment, total	.....	63,456	.....	64,935
Evaporative condensers	4,912	7,326	6,216	8,652
Air-conditioning units (not self-contained)	43,492	14,534	33,263	14,636
Unit coolers, refrigeration	76,703	11,492	88,718	12,660
Other heat-exchanger equipment	.....	30,104	.....	28,987
Self-contained air-conditioning units, total	424,105	133,101	282,488	93,573
Window-sill type	357,106	67,271	228,964	42,442
Other than window-sill type	66,999	65,830	53,524	51,131
Other air-conditioning and refrigeration equipment, total	.....	40,668	.....	36,537
Centrifugal refrigeration sys.	363	14,040	441	15,300
Ice-making mach.	26,693	12,838	12,998	8,804
Year-round air-condition. units (self-contained, except heat pumps)	10,473	6,876	7,728	5,863
Mechanical dehumidifiers, refrigeration type	72,017	5,201	75,659	4,731
Absorption & adsorption sys. & equipment	119	1,713	138	1,839

ments by manufacturers for 1953 will be about eleven times as much as in 1949, four years ago.

"People are buying more and more of the larger sizes with the three-quarter-ton room air conditioner proving by far the most popular model," says George S. Jones, Jr., managing director of ACRI.

• George P. Hough, Chicago, who is one of the assistants to the president of the A. O. Smith Corp., has been given the additional duty of chairman of the operating committee of the Permaglas-Heating Division at Kankakee.

STOP THAT NOISE!

...in the pipes

WITH THE WEATHER-FLO

the indoor-outdoor control

that fits any job—*on the job*

Stops "Expansion" Noises: Instead of slugging through a shot of "hot" water every once in a while as a room thermostat does, the Weather-Flo circulates water constantly, warmed just enough to replace the heat that's being lost. Eliminates rapid water temperature changes . . . rapid expansion and contraction of radiators and pipes. Stops the noises pipes make when rubbing against joists. Minimizes the possibility of "leaks."

Stops "Entrained Air" Noises: By keeping the water circulating constantly—at weather controlled modulated temperatures—air is never allowed to accumulate anywhere in the system. This eliminates that annoying gurgling noise in the pipes that occurs when the circulator first starts up.

Get all the facts on the Weather-Flo. Write for Bulletin F-453.

AUTOMATIC DEVICES CO., INC.

WESTERN SPRINGS, ILLINOIS

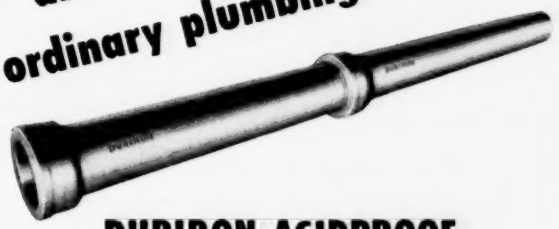
The new HERMAN NELSON GAS FIRED Unit Heaters are made in seven sizes with heat output ranging from 20,000 to 160,000 B.T.U.'s per hour.

For some "HOT NEWS" on these new heaters write to.....

American Air Filter
COMPANY, INC.

215 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P. Q.

The permanent drain pipe installed by ordinary plumbing methods

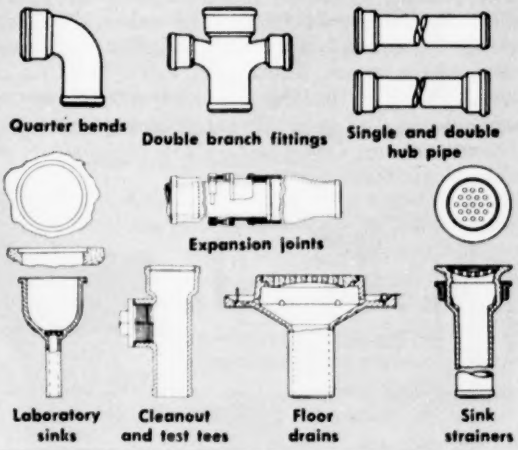


DURIRON ACIDPROOF DRAIN PIPE AND FITTINGS

Duriron is a high silicon iron alloy highly resistant to most commercial acids at practically all temperatures and concentrations. It is not a coating—the entire thickness of the pipe wall is resistant to abrasion and erosion as well as to corrosion.

The labor cost of installing Duriron is the same as with ordinary cast iron soil pipe. Normally the initial cost is the final cost since Duriron will generally outlast the building in which it is installed.

SOME OF THE MORE THAN 60 STANDARD DURIRON FITTINGS



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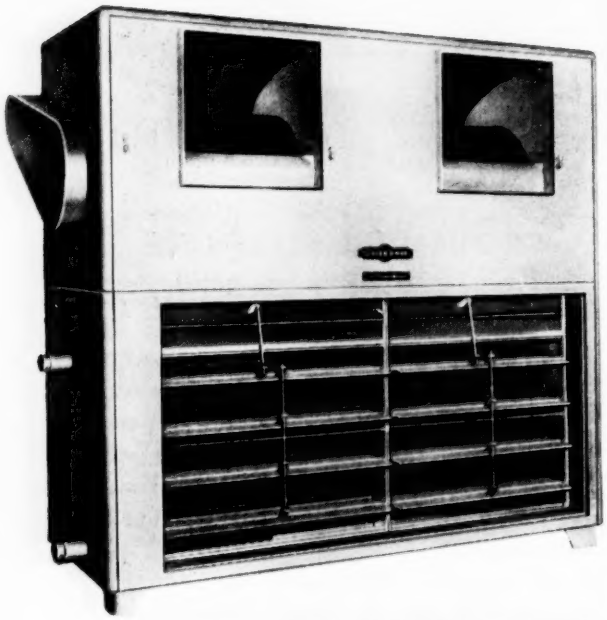
DURIRON
LOOK FOR THE NAME ON EVERY PIECE

Govern air conditioning costs...



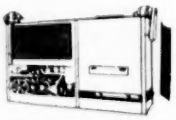
with GOVERNAIR!

Governair keeps costs under control — as well as giving you *governed air!*

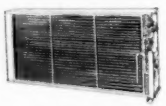
The Governair fan and coil cabinet unit shown above is a deluxe component of high quality air conditioning systems that employ directly expanded refrigerants or chilled water. A large capacity air handler especially designed for installations where space limitations exist. Heating is accomplished by the use of steam or hot water.

For the answer to your air conditioning costs and problems, call on Governair — *the *originators of packaged air conditioners!*

AIR CONDITIONERS



COMPLETELY PACKAGED AIR CONDITIONERS*



BLAST COILS FOR HEATING & COOLING

*Type SCU Conditioners — Patent No. 2,297,928

GOVERNAIR

TYPE SC CONDITIONERS

Governair Corporation, 513 N. Blackwelder, Oklahoma City, Okla.

AEROSOL CAMERA

photographs .0005-inch particles in air by Tyndall effect in 2-million-candlepower beam.

A new camera for photographing microscopic particles floating free in the atmosphere has been announced by Stanford Research Institute. The experimental camera is able to photograph aerosols as small as one two-thousandth of an inch. Institute scientists are currently putting their aerosol camera through exhaustive tests. The pilot model will undergo continuous modification based upon operating experience.

Paul L. Magill, technical director of SRI's air research laboratories, says, "The aerosol camera will give air researchers an opportunity to study aerosols in their natural state. Previous microscopic techniques have required collection of the particles on slides."

When fully perfected, the 500-pound camera should indicate whether or not the process of settling or precipitating particles upon a slide alters or destroys some of them, according to Magill.

• **HOW IT WORKS.**—The camera's depth of field is 200 microns (a micron is 1/25,000 of an inch). Instead of a mechanical shutter, pulsed flashes of a narrow-beam light provide the film exposure. The flashes—of 2,000,000 candlepower intensity—may be one, four or ten microseconds duration, or from one millionth to ten millionths of a second. The number of flashes may be regulated at any number up to 100 exposures per second. Approximately 15,000 volts are delivered to an air-cooled flash tube for the illumination.

In a "pea-soup" fog, scientists have counted up to 2,000 aerosol particles per cubic inch. Since aerosols are constantly circulating, it is calculated that twelve exposures would be required to catch at least one particle. A moderate fog would require ten to twenty times as many exposures to be sure of finding an aerosol particle. The camera's design allows its operator to expose each 5x7-inch film as many times as desired.

SRI scientists have made as many as 6,000 exposures on a single film without clouding or obscuring any image. Aerosols in the field of focus show up black.

Magill says the camera may enable scientists for the first time to follow and record the history of an unstable aerosol particle over a short period.

COOL HOMES

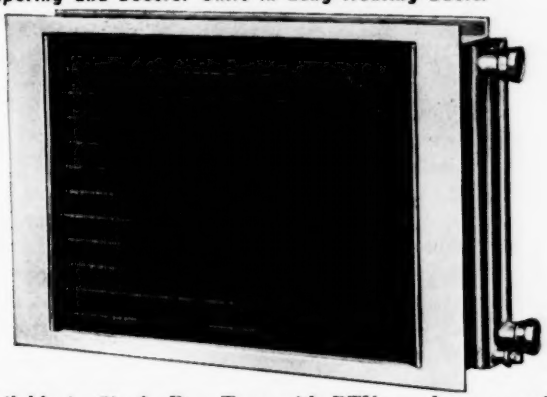
assured as experts predict a $750 million residential air conditioning industry in next few years.

A $750 million residential air conditioning industry is in the making and may be attained in the next three or four years—whereas right now it's a $75 million industry, according to Ned Cole, chairman of the air conditioning committee of the National Association of Home Builders.

(*Continued on page* 138)

New... REMPE "Hi-Cap" STEAM HEATING COILS WITH DEFROSTER

For Use In Combination With Air Conditioning Coils Or As Tempering and Booster Units in Long Heating Ducts.



Available in Single Row Type with BTU per hour capacity from 60,000 to 360,000. In Double Row Type, for heavy duty service, in capacities from 129,000 to 775,000 BTU per hour. Heavy gauge steel casings. Copper tubes and headers. Tested 350 lbs. air pressure for steam working pressures up to 125 lbs. Defroster-standard equipment. Also suitable for hot water.

Write for Details

HEAT TRANSFER EQUIPMENT REMPE CO. Founded 1890

REMPE COMPANY

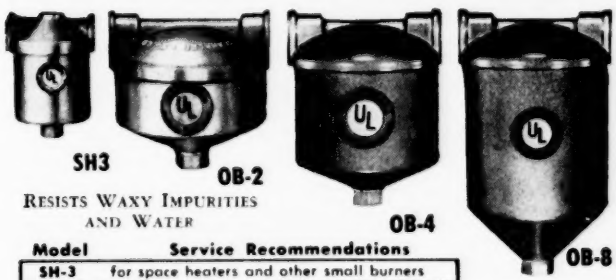
358 N. Sacramento Blvd., Chicago 12, Ill.

Complete facilities for fabrication of pipe coils—all types—all materials. Engineering service. Send details for price.

"SPARKLER FUEL OIL FILTERS

. . . have saved me a lot of grief in servicing burners"

—says one fuel oil dealer. If you keep the fine tank rust out of the fuel line you don't have clogged burner tips. The rayon filtering element in a Sparkler filter does just this, consistently all during the heating season.



RESISTS WAXY IMPURITIES AND WATER

Model	Service Recommendations
SH-3	for space heaters and other small burners
OB-2	for average home burner
OB-4	for apartment buildings and small steam boilers
OB-8	for industrial burners

Available from all oil burner jobbers

SPARKLER *Write G. Harry DeGraw for particulars*

MANUFACTURING CO., Mundelein, Ill.

Makers of filters for the petroleum industry for over a quarter of a century

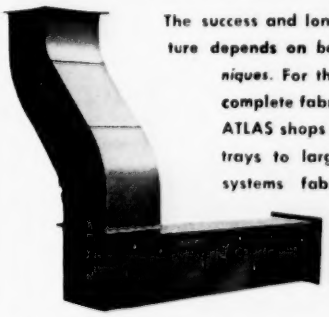
Economical protection that is built . . . NOT APPLIED

AMPCOFLEX® is an unplasticized, rigid polyvinyl chloride. It is corrosion-proof all the way through . . . and self-supporting as well. It has no coating to wear with time . . . nor edges or under-surfaces that ever become exposed and corrode. AMPCOFLEX Fabrications provide you with the long-term, economical solution to many industrial corrosion problems.

While only one-half the weight of aluminum, AMPCOFLEX has a tensile strength of 9000 psi at 75° F. It is inert to most acids, salts, alkalies and standard pickling and plating solutions.

One of the more important uses of AMPCOFLEX is for fume exhaust systems. Here, additional properties of impermeability, high dielectric strength and low fluid friction factor are definite advantages.

AMPCOFLEX . . . plus ATLAS specialized experience and fabrication facilities



The success and long life of a corrosion-proof structure depends on *both materials and construction techniques*. For this reason, ATLAS has developed complete fabrication facilities for AMPCOFLEX. ATLAS shops will produce any item from small trays to large tanks and complete exhaust systems fabricated of unplasticized, rigid polyvinyl AMPCOFLEX. In addition, ATLAS will furnish necessary pipe, pipe fittings and accessories.

For Complete Data, write for Bulletin 9-1.
ATLAS MINERAL PRODUCTS CO.
MERTZTOWN, PENNA. • Houston 1, Texas

self-supporting, corrosion-proof structures

ATLAS Ampcoflex FABRICATIONS

"K" Fittings in Another Great Building

It is common practice for "K" Fittings to be used in buildings of all types and sizes. So we are not citing their use in the Government Accounting Office Building as something unusual, but the structure itself is interesting.

The outside dimensions are 328 x 578 ft. The building is seven stories high, with basement and subbasement. It houses 9,000 people. Feeding service accommodates 2,000 at one seating. An auditorium seats 250. There are garage facilities for 800 cars.

Pipe fitters like to work with "K" Fittings. The threads are tapped full and clean. Openings are chamfered so pipe enters easily. Precise angularity of machining assures symmetrical runs. Uniform walls and high tensile strength give "K" Fittings the stamina to withstand the most severe make-up strain.

It pays to order fittings from distributors who handle the "K" line.

Good workmanship sells "K" Fittings

K PIPE FITTINGS
CAST IRON AND MALLEABLE
3,000 Shapes and Sizes

Complete information gladly furnished.

THE KUHNS BROTHERS COMPANY
Dayton 1, Ohio
Established 1887
Combined marketing facilities with Malleable Iron Fittings Company, Branford, Conn.

(*Continued from page* 136)

At a two-day meeting of the committee in New York, Mr. Cole said that the industry must consolidate itself and "present a solid front" if it is to score this ten-fold advance.

• **FINANCE.**—"We must have this solid front because under present conditions the FHA and VA do not have adequate information and assurance to give the air conditioning field the support, in financing of installations, that it deserves and needs.

"The first step in achieving this goal is the pooling of research data by manufacturers, so that a standard base for overall design requirements can be worked out.

"In the heating industry contractors and builders are able to install systems based on standard measurements of heat loss and heat gain. But in the air conditioning industry each manufacturer has his own set of figures on heat losses and other pertinent data.

"That is why the FHA and VA in Washington cannot give the air conditioning field the full support that it deserves. The FHA and VA need a standard to go by. What we need is a streamlined financing plan in order to reach the mass home market. The FHA can give us this—if we give them the tools."

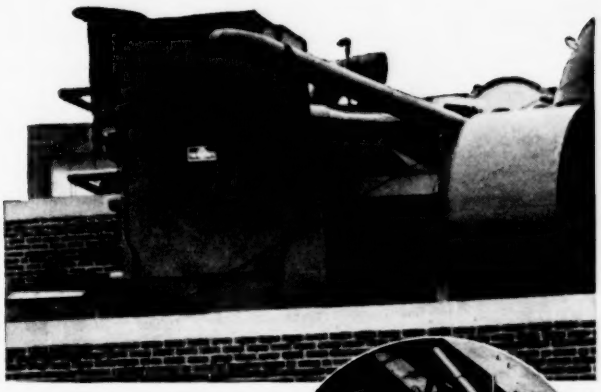
• **DESIGN.**—Richard G. Hughes, NAHB vice president and a prominent builder from Pampa, Texas, stressed that present government housing agency practice on the local level does not permit design changes which sharply reduce building costs. He said these design adjustments are needed for efficient installation and operation of air conditioning units, particularly for small houses in the lower price brackets.

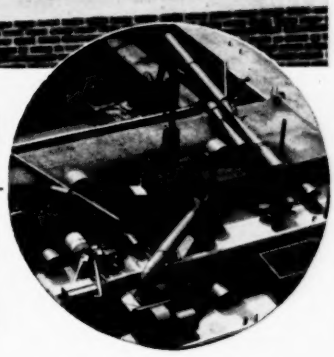
At the present time loan applications in which air conditioning is involved are being handled by FHA field offices because of the need for knowledge of local conditions, whereas ordinarily building loan applications are handled in Washington.

In order to reach desired standards in the field, Cole suggested, test villages could be constructed throughout the nation in a cooperative undertaking of air conditioning manufacturers and the building industry. Data from these tests would form the nucleus for a set of uniform air conditioning requirements with which all builders of government-financed housing could comply.

Members of the NAHB air conditioning committee who were present at the meetings, in addition to Cole and Hughes, were: Jack Sargent, Topeka, Kan. builder; William G. Farrington, Houston, Tex. builder; Chris Christianson, assistant technical director of the NAHB; Andrew Place, South Bend, Ind. builder; and Harold Sarshik, Camden, N. J. builder.

• At the 81st annual meeting of the American Public Health Association and annual sessions of 40 related organizations at the Hotels Statler and New Yorker, New York City, November 9-13, sessions will be devoted to industrial hygiene and sanitation, school health programs, nutrition and dietary developments, control of animal disease, maternal and child health, accident prevention, home nursing, laboratory and engineering developments.





DRY, FRESH -------AIR-------- *For a Supersonic* WIND TUNNEL

● New and improved, this NIAGARA METHOD that effectively dries outdoor air for a wind tunnel used for testing at supersonic speed, can be trusted to give you the best air conditions for your purpose:

- **to dry your materials or products**
- **to prevent condensation or moisture damage**
- **to protect your moisture-sensitive processes**
- **to give you an atmosphere in which your product can be packaged or stored safely**
- **to give you exactly the right atmospheric conditions for testing materials**
- **to put "fresh air" back into your air conditioning, increasing its capacity and effectiveness**

The Niagara "fresh air" Method removes the excess moisture from outdoor air by contact with an absorbent liquid in a spray chamber. The liquid contact temperature and the absorbent concentration, both controlled thermostatically, determine the amount of moisture in the conditioned air. Heating or cooling the air is a separate function. Therefore, you can easily and inexpensively have a precisely controlled condition without the use of moisture sensitive instruments.

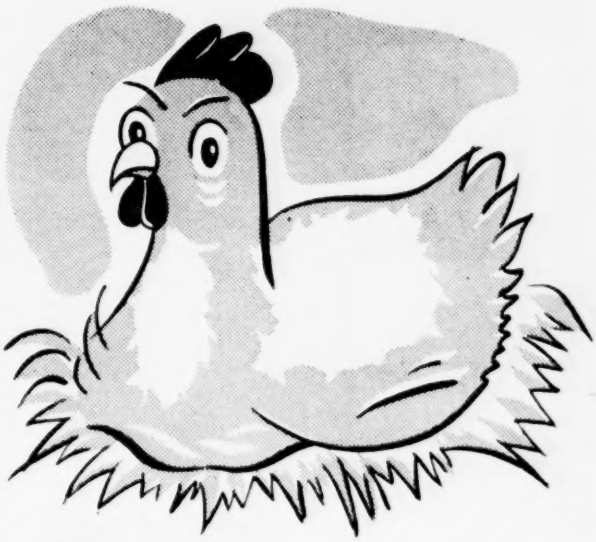
The Niagara Absorbent Spray Method is noted for solving the really difficult problems of air conditioning. Write for complete information.

NIAGARA BLOWER COMPANY

Over 35 Years of Service in Industrial Air Engineering

Dept. HV, 405 Lexington Ave. New York 17, N. Y.

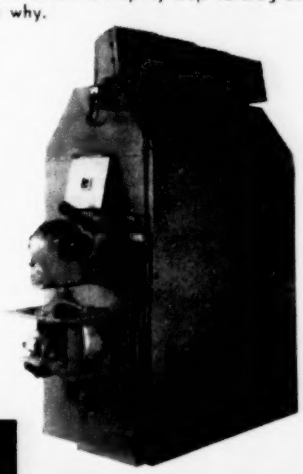
Field Engineers in Principal Cities of U. S. and Canada



Heating Surface . . .

Satisfactory results from a heater also depend on the heating surface—Olson Engineers consider it the very soul of a heater—long life—and maximum efficiency depend on the amount of heat transfer surface. Olson, through the use of standard 10 gauge, 4" O.D. boiler tubes, gives even more effective heat transfer surface than the highest recommendation of accepted heating authorities.

The fact that Olson Heaters are built rugged for dependable service can not be denied—Write for the detailed step-by-step catalog and you'll know why.

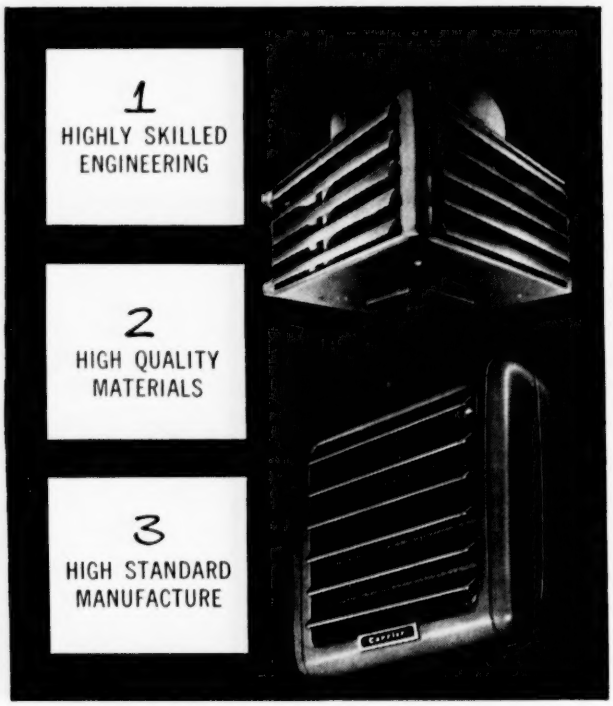


Olson

DIRECT FIRED HEATERS

Gas, Oil, Coal or Dual Gas and Oil

ARTHUR A. OLSON & COMPANY
BROAD STREET, CANFIELD, OHIO



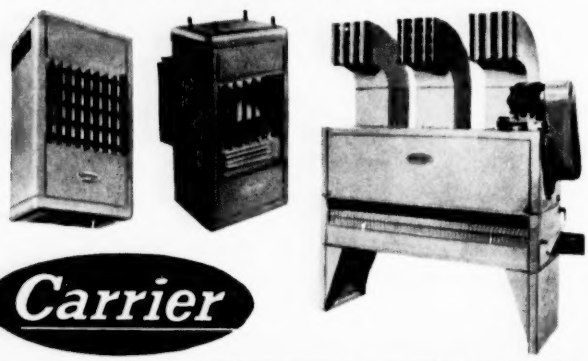
They make the difference in **Carrier** Unit Heaters

. . . a difference that is fundamental; that leaves no doubt about the high efficiency, economical operation and long-lasting construction of these sturdy steam (or hot water) space heating units.

For higher ceiling installation the *Carrier Fourway Directed-flo Unit Heater* has no superior for flexibility. It fan-propels warmed air in any or all four directions; at any angle, up or down; in any volume. It has both ruggedness and good styling. Seven sizes, 82,400 to 502,000 Btu's.

For directional fan-propelled warm air distribution from heights up to 18 feet, the modern-design *Carrier Horizontal Discharge Unit Heater* is unexcelled for use in stores, salesrooms, restaurants. Ten sizes, 21,000 to 200,000 Btu's.

WRITE FOR FURTHER INFORMATION on the above, or on either of the units shown below: Carrier Heat Diffuser (right); Carrier Gasfired Unit Heaters—fan-propelled (left). Address Carrier Corporation, Syracuse, New York.



Carrier

AIR CONDITIONING • REFRIGERATION • INDUSTRIAL HEATING

WATER USAGE

follows nationwide trend to more and more local restrictions, Chrysler survey reveals.

Evidence of a national trend to more and more restrictions on unlimited use of water has come to light in a recently-completed survey by Chrysler Corp.'s statistical department. In just four years, declared C. E. Buchholzer, president of Chrysler's Airtemp Division, the number of communities in the country restricting unlimited water usage has actually doubled.

In 1949, only 104 localities reported they had passed restrictions or were seriously considering the passage of some type of regulation against unlimited water usage. The number of cities reporting water-conservation measures in 1953 is 225.

• **WHY.**—Principal reasons for the regulations are inadequate water supply and sewage facilities. Detroit is an outstanding example of this situation. Unlimited water supplies are readily available. But the city's growing industrial and residential demand for water exceeds distribution and sewer facilities. And there is little relief in sight before 1954, local officials have stated. In the west and southwest, a plain lack of water has caused stringent regulations even on normal usage.

ELECTRIC MOTORS

to pack more horsepower in smaller frames using new materials. NEMA issues new standard.

New broad standards allowing more horsepower to a frame size for all of the popular high production alternating current type electric motors from 1 to 30 hp, were announced July 8 by C. O. Hedges, chairman of the Motor and Generator Section of the National Electrical Manufacturers Association, in a meeting with representatives from the automotive and machine tool industries.

• **MATERIALS.**—The advent of superior synthetic insulating materials, new and better silicon steels and improved techniques as well as real advances in the art of motor design, are cited as developments which permit packing more horsepower into electric motors for a given size and space.

• **STANDARDS.**—The new motors, Mr. Hedges declared, will continue to satisfy fully the same performance standards of torque, temperature rise, and starting current limitation as before. These standards, while using fewer frame sizes to cover the same range of horsepower, will retain the previous frame numbering system.

Complete data on derivatives, types of mountings, etc., are now available. Frame assignments have been made to cover the 2-through 12-pole speed ratings for the open and the totally-enclosed fan-cooled types.

As in the past, the standards have been laid out to afford maximum interchangeability between the totally-enclosed fan-cooled ratings and the open-type ratings by

(*Continued on page* 142)

Cancer strikes 1 in 5

Strike back

Give

Your gifts to the American Cancer Society help guard those you love.

Your dollars support research in a hundred laboratories and universities . . . spread life-saving information . . . ease pain and suffering . . . provide facilities for treatment and care of cancer patients.

It is a sobering fact that cancer may strike anyone tomorrow: strike back today with a gift to the American Cancer Society. You may mail it, simply addressed CANCER, c/o your local post office.

American Cancer Society

NEW DRIVE-IT 320

with

BREAK-OPEN ACTION

MAKES SPLIT-SECOND FASTENING TO CONCRETE OR STEEL... EASIER THAN EVER

BREAK-OPEN ACTION for fast, easy loading and extraction makes new **DRIVE-IT** "320" the easiest operating stud driver on the market. This smooth-working action means a greater saving to you on concrete or steel fastenings.

Here are other exclusive **DRIVE-IT** features that make it the best tool available:

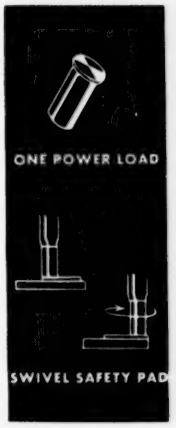
ONE POWER LOAD. No need to buy and stock various strength power loads with exclusive **DRIVE-IT** power control method.

AUTOMATIC EXTENSION BARREL allows fastenings inside junction boxes and other recesses. No need to buy and attach extra barrels.

SWIVEL SAFETY PAD of tough rubber and steel protects operator and permits fastenings next to walls.

SAFE two-handed firing sequence and length of tool offer maximum protection. Can't be discharged accidentally or in mid-air.

DRIVE-IT pins are listed and approved by Underwriters' Laboratories.



DRIVE-IT *the original* **POWDER ACTUATED TOOL**

MAIL NOW FOR MORE INFORMATION

POWDER POWER TOOL CORP.
New Drive 320 Portland 1, Oregon

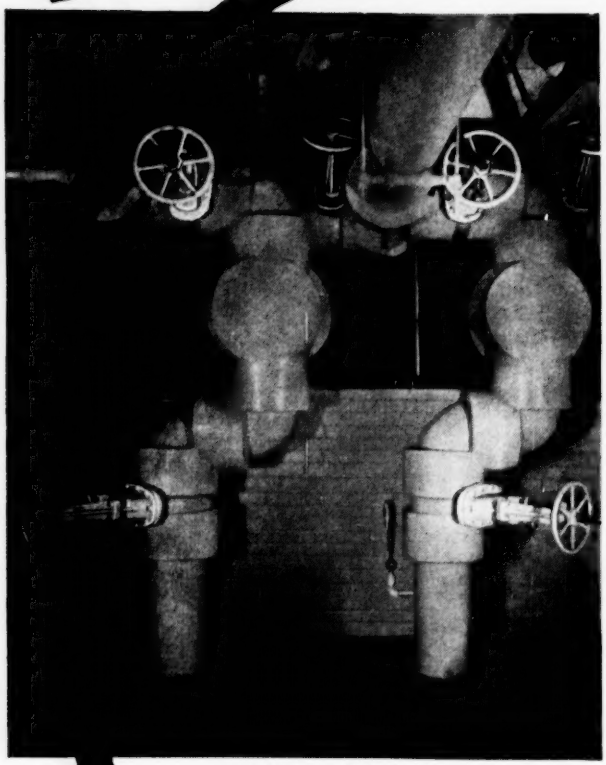
☐ We would like a free demonstration of DRIVE-IT.
☐ Please send literature on new DRIVE-IT 320.

NAME_____

ADDRESS_____

CITY_____ STATE_____

Proved DEPENDABLE



• Call it reliable!
• Call it rugged!
• Call it dependable!
• If it is a Fairbanks valve
. . . it has it!

Thousands of installations under every condition from the simplest to the most difficult, prove Fairbanks valves give dependable service, require less maintenance, last longer — often succeed where other valves fail!

That is why you find more uninterrupted service, less shutdown, in plants that specify Fairbanks 125-pound Iron Body Gate Valves — the valves with proven dependability built in!

•

Fairbanks Iron Body Gate Valves are bronze mounted* both with inside non-rising screw and outside screw and yoke. Available with screwed or flanged ends. Bodies and bonnets made of high strength alloy cast iron. Wedges in 2" to 4" sizes of solid bronze; in larger sizes to 24", wedges are alloy iron with rolled in bronze face rings and bronze bushed stem connections. The threaded bronze seat rings are screwed into body at angle conforming to taper of wedge.

(*ALL IRON GATE VALVES ALSO AVAILABLE.)

THE Fairbanks COMPANY
393 LAFAYETTE STREET NEW YORK 3, N. Y.
Branches: New York 3 • Pittsburgh 22 • Boston 10 • Rome, Ga.
TRUCKS • CASTERS • DART & PIC UNIONS • VALVES

(*Continued from page* 140)

utilizing the same horsepower-frame relationship as far as possible.

• **ADVANTAGES.**—In this re-rating program, Mr. Hedges continued, for a while there will be some industrial users of electric motors who will have to stock additional renewal parts and, perhaps, additional spare motors during the transition period. But, more horsepower for a given size, lower space and storage costs, more economical mounting platforms, and easier installation and maintenance are advantages of the change-over which will shortly out-weigh all other considerations.

For the electric motor manufacturers, he pointed out, the new standards, for the first time in 25 years, offer an opportunity to make full use of new techniques and technological advances. However, the new program, for them, involves a substantial amount of engineering, development, testing, and re-training of factory personnel, as well as changes in production facilities and techniques. Therefore, it is estimated that the first of the new motors should become generally available early in 1954. Naturally, each company will determine and announce when its motors, built to the new standards, will be ready for market.

ASBESTOS

reclaimed from used pipe insulation by simple process developed at National Bureau of Standards.

Simple, effective procedures for reclaiming asbestos from discarded pipe insulation have been developed by E. W. Zimmerman of the National Bureau of Standards. Extraneous material is removed from the asbestos cloth by chemical treatment, and the cleaned cloth is reduced to fiber form in a paper-pulp beater. The recovered asbestos is unchanged chemically, with little or no shortening of the fibers. It appears well suited to further use as electrical and heat insulation, for making asbestos paper, and as a filler in a number of molded plastic compounds.

For applications where flexibility is desired, such as asbestos paper or cloth chrysotile asbestos is used. Although this type of asbestos is quite satisfactory for insulating heated pipes, it loses its water of constitution and becomes brittle when heated to about 800°C. It was therefore necessary to develop procedures that would reclaim the asbestos fibers without the use of excessively high temperatures.

• **PROCESS.**—It was found that asbestos or asbestos-cotton fabrics other than those containing paint can be freed of adhering cement by first treating with 5-percent hydrochloric acid and then rinsing. Fabrics painted on one side are treated with alkali instead of acid to remove the paint as well as the cement. This is accomplished by boiling in 5-percent sodium hydroxide solution for 15 to 30 minutes, followed by a preliminary rinsing, a warm wash with a synthetic detergent to remove the paint pigments, and a final thorough rinsing.

HEATING AND VENTILATING'S

Ad-Digest SERVICE

A new service for readers of HEATING AND VENTILATING

Below and on the following pages are given brief digests of the advertisements appearing in this month's issue of HEATING AND VENTILATING. Use this Digest to locate and refer to the advertisements in which you are particularly interested, then fill out and mail the prepaid postcard to request further information from manufacturers.

NOTE: While every attempt is made to list all the advertisements appearing in HEATING AND VENTILATING, we cannot guarantee including those which are received after our published closing date. The Index of Advertisers lists all the advertisements in this issue.

DIFFUSER REGISTER. Page 149. A diffusing type floor register designed for perimeter heating with warm air in 4 and 6-inch widths. Ideal for installations other than perimeter heating such as in stairs and under kitchen cabinets. Catalog available. ----------Item 201

WATER CHILLER. Page 20. A water chiller installation is described where 270 gpm of water were cooled 12 degrees from 57F with a refrigerant temperature of 40F. Efficiency, versatility and safety are stressed. ----------Item 202

AIR FILTERS. Page 157. Dust and grease filters which cost no more yet have drain slots for easier cleaning, bronze welded corners, galvanized steel frames, and expanded metal face plates. ----------Item 203

CONVECTORS. Page 34. Recessed or free-standing convectors featuring performance, appearance, and easy maintenance are offered as supplementing a complete line of unit and direct fired heaters. ----------Item 204

THERMOVALVES. Page 21. One simple control valve which does the work of many small valves or expensive distributor headers feeding as many as 36 circuits equally. In use have increased coil capacity as much as 35% Catalogs available ----------Item 205

FIRE PROTECTION EQUIPMENT. Page 153. A new catalog is available from this company which is first in interior fire protection equipment. ----------Item 206

DUST COLLECTORS. Page 62. A hydrostatic dust collector with improved and simplified entrainment separators with low cost maintenance available in four larger sizes with capacities up to 50,000 cfm and with additional access doors with improved hinges. Numerous other new features. Bulletin available. ----------Item 207

GAS UNIT HEATERS. Pages 26-135. A new line of gas fired unit heaters featuring economical installation in seven sizes with input ranging from 25,000 to 200,000 Btu per hour. ----------Item 208

EXPANSION JOINTS. Page 17. No matter what expansion joint you need, look first among this line of 6500 standard slip models. King of the line is the piston ring type illustrated and described. Feature is that it can be unpacked and repacked under pressure. Bulletin available. ----------Item 209

Circle numbers corresponding to the advertisements in which you are interested, print your name and address clearly. Information will be sent directly from manufacturers.

RADIANT HEATING. Page 64. Radiant heating has advantages from both the owners' and tenants' viewpoints including comfortable heat, cleaner air, freedom of decoration from unobstructed wall space. For radiant heating, steel is most widely used pipe. 48-page booklet available. ----------Item 210

AIR CONDITIONING. Page 54. An air conditioning system consisting of individually controlled units remotely located from the cooling and heating source and employing well water for cooling. Intended for commercial, institutional and other multi-room buildings. Brochure available. ----------Item 211

AIR OUTLET. Page 41. Draftless diffusers for high velocity air systems shown in a typical hospital application induce into the device room air up to 100% of primary air supply. For single or dual duct systems, manual or automatic controls for walls or ceilings. Manual available. ----Item 212

EXHAUST SYSTEM DUCT. Page 137. A rigid polyvinyl chloride plastic that is corrosion-proof and self-supporting is used in the fabrication of fume exhaust systems and structures. Bulletin available. ----------Item 213

REGISTERS. Page 145. All steel registers for walls or ceilings are preferred because of their greater strength, neater appearance, easier maintenance and other features. A register book is available. ----------Item 214

INDOOR-OUTDOOR CONTROL. Page 135. A control for heating systems stops noisy operation by modulating water temperature while circulation remains constant. Eliminates rapid expansion of pipes. Stops entrained air noises. ----------Item 215

BOILER TUBE. Page 63. Quality boiler tubes stressing dependability, uniform wall thickness, freedom from scale, and consistent physical properties under severe heating and pressure conditions. Item 216

SPEED CONTROLLERS. Page 155. Made to fit the speed requirements and load factors of blower and fan applications, speed controllers for AC shaded pole motors provide one or more reduced speeds. Brochure available. ----------Item 217

AIR CONDITIONERS. Page 150. Seven sizes of air conditioning units, 1,000 to 14,000 cfm, cooling and heating. Built in sections for vertical or horizontal mounting and in a variety of combinations. Catalog available. ----------Item 218

COAL BURNING EQUIPMENT. Page 127. Plant modernization by installation of new bituminous coal burning equipment may cut fuel costs 45%. ----------Item 219

STEAM GENERATOR. Page 44. A two-pass design self-contained automatic steam generator. Two pass design eliminates baffles. One feature is that it takes one man less than 30 minutes to open this boiler for cleaning or inspection. Catalog available. ----------Item 220

PLEASE SEND US MORE INFORMATION.

Circle below item numbers on which you wish further information.

201	202	203	204	205	206	207	208	209	210	211	212	213	214
215	216	217	218	219	220	221	222	223	224	225	226	227	228
229	230	231	232	233	234	235	236	237	238	239	240	241	242
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285	286	287	288	289	290	291	292	293	294	295	296	297	298
299	300	301	302	303	304	305	306	307	308	309	310	311	312
313													

PLEASE PRINT Sept. H-53

Name ..... Title .....

Firm .....

Nature of Firm's Business .....

Street .....

City ..... Zone..... State .....

This card is void after Dec. 1, 1953

HEATING and VENTILATING'S

Ad-Digest SERVICE

UNIT AND SPACE HEATERS. Page 146-7. Four big profit opportunities with this company's gas fired unit heaters, with small size, lightweight, fan circulating, gas space heater, a radiant circulating gas heater, and a radiant panel gas heater. ----------**Item 221**

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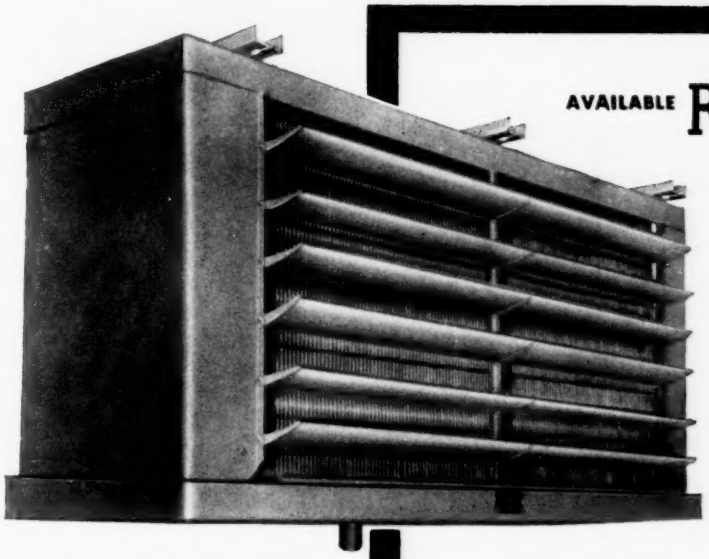

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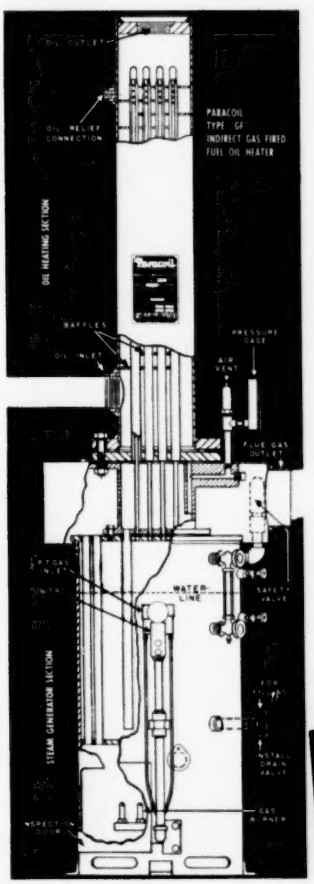

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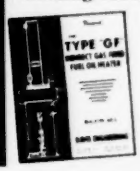

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WHAT WOULD YOU DO

(Coninued from page 108)

unit heaters are used on one-pipe or two-pipe gravity systems, the traps should usually be omitted from the return connections since the pressure transmitted through the heater with that exerted by the head of water due to the heater elevation, provides the force to return the condensate to the boiler.

Unit heaters which drain into system returns that use devices such as condensation pumps, vacuum pumps or return traps for forcing the condensate from them to the boiler, should use traps in the heater return connections.

The term "return trap" was used in the question as presented in the problem, but presumably the writer had in mind "separating traps" or the type which retains steam and permits the flow of condensate and non-condensible gases, and not the devices known in the trade as "return traps" which are used for returning condensate into a boiler against a pressure or from a lower pressure to a higher pressure such as from a vacuum into the atmosphere.

D. N. Crosthwait
Technical Advisor
C. A. Dunham Company

Michigan City, Ind.

LEADING CONTRACTORS prefer Auer "K" ALL STEEL REGISTERS for walls or ceilings—

HERE'S WHY:

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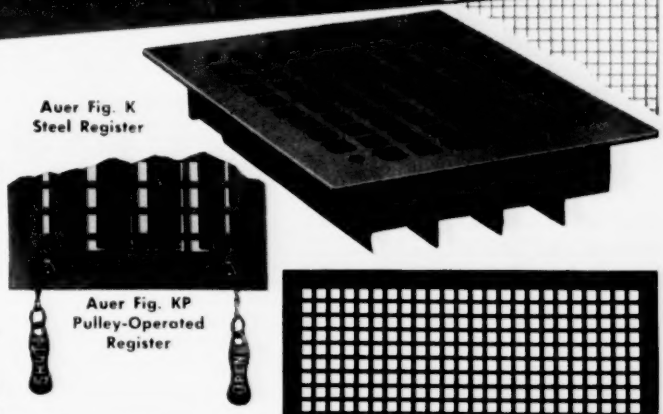
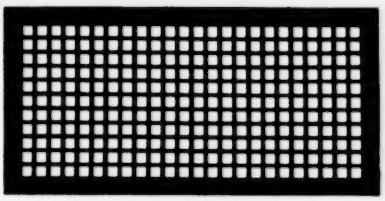


Auer Fig. K Steel Register

Auer Fig. KP Pulley-Operated Register



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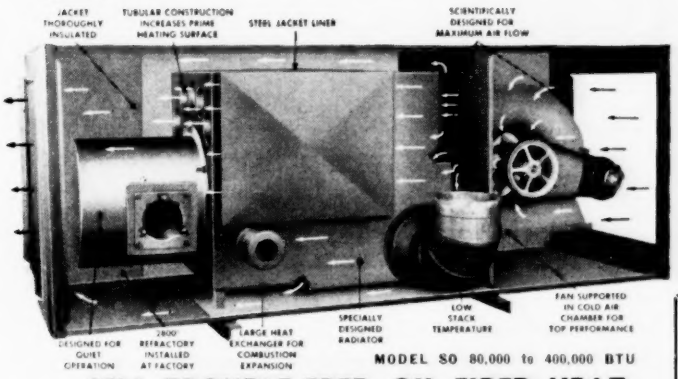
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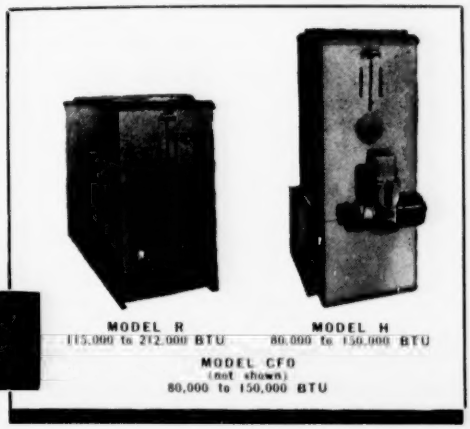

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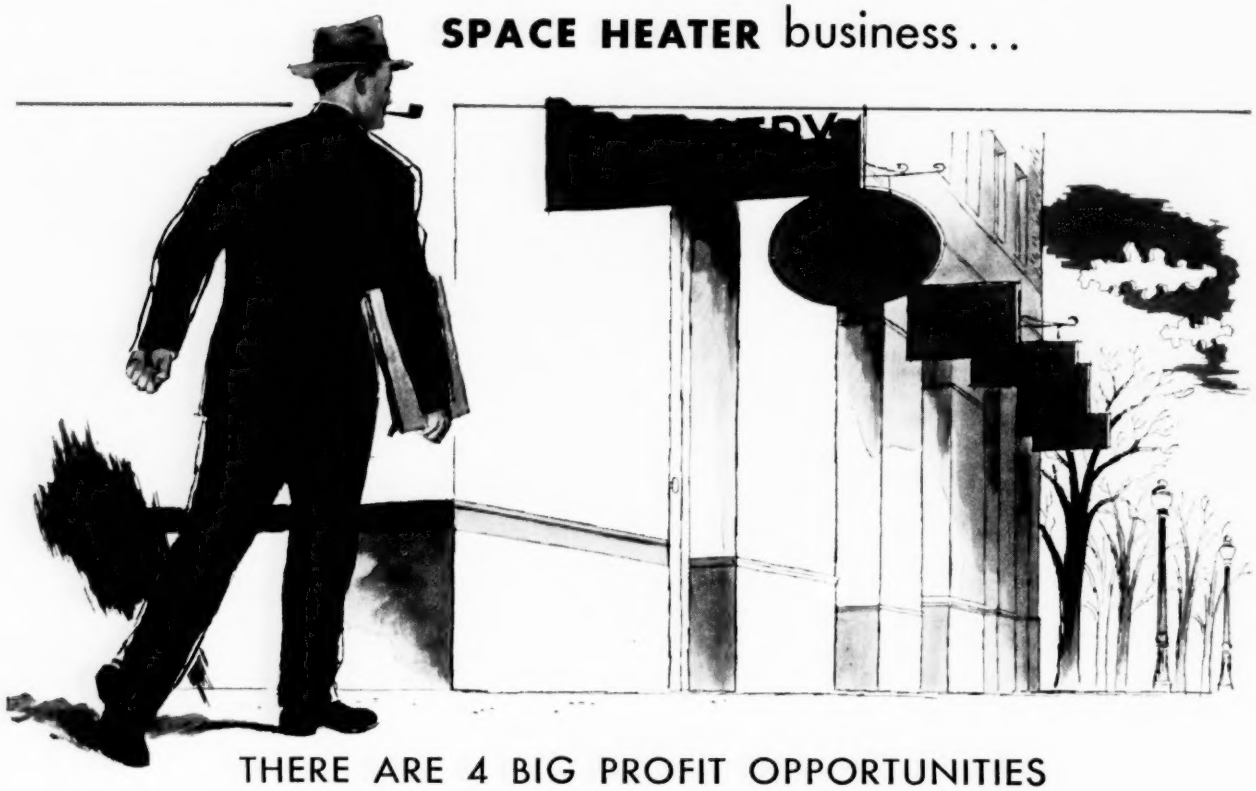

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1. ***The 327 Unit Heater***—the smallest unit in relation to capacity on the market today! Its small size and light weight make it less costly to install. Improved design provides quiet operation . . . more comfortable heat because fan starts only after element gets warm. It's a superior unit at a competitive price. And there are sizes for every requirement.

2. ***The 428 Space Heater***—a fan circulating heater with the one big feature that other units lack—*no forward air-blast*—the result of an exclusive, patented front that gently diffuses warm air. It's quiet . . . it's attractive . . . it really sells.

3. ***The 426 Radiant Circulating Heater***—a smartly styled console-type heater that offers new benefits in comfort and safety. It's available in four sizes, all A.G.A. approved for all gases.

4. ***The 401 Radiant Panel Heater***—a slim, trim radiant circulating heater that mounts on the wall. It installs easily. There's no need to cut floors or carpeting. And it's fully "flame-protected" from children's hands.

For more details call your Bryant distributor or write: Bryant Heater Division, Affiliated Gas Equipment, Inc., 17825 St. Clair Avenue, Cleveland 10, Ohio.

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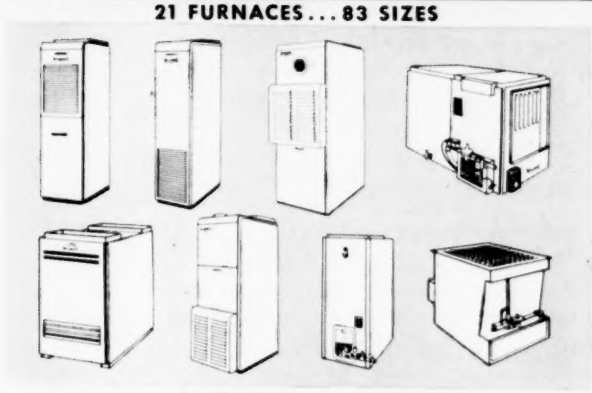
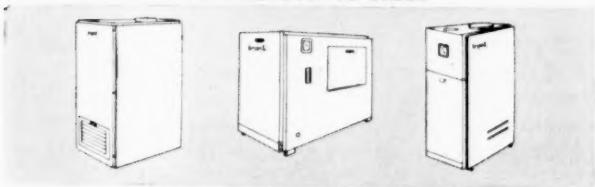
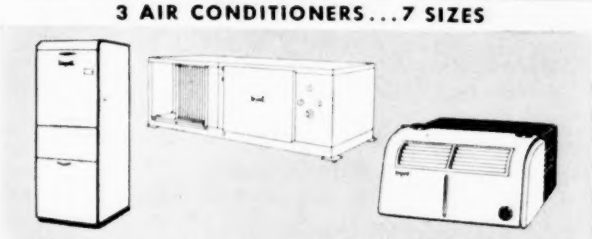


4 BOILERS... 45 SIZES

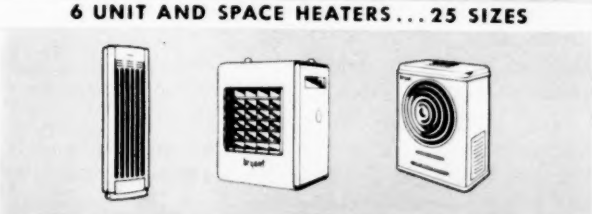


5 WATER HEATERS... 15 SIZES

3 AIR CONDITIONERS... 7 SIZES



6 UNIT AND SPACE HEATERS... 25 SIZES



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HEATING • AIR CONDITIONING • WATER HEATING

(*Continued from page* 113)

pany, and F. A. Annett, consulting editor, *Power*, is now in its second edition. The first edition was published in 1940.

Without the use of involved mathematics, the authors explain how to select and install pumps, how to operate and maintain them, and how to locate and remedy pump troubles. Some of the applications covered include boiler feed, paper stock, deep well, sewage and sludge, chemical, food products, oil field, gasoline line, fire, corrosive, mine, etc.

While the new edition duplicates the character of the old in presenting a practical study of the various types of pumps, new material has been added and some of the chapters have been rewritten. The chapters cover reciprocating pumps volute-type centrifugal pumps, diffuser-type centrifugal pumps, turbine pumps, propeller pumps, rotary pumps, deep-well pumps, boiler feed pumps, sewage and sludge pumps, sanitary pumps, variable displacement and proportioning pumps, methods of priming pumps, head, economical pipe size for pumps, pump operation, selection and installation, and centrifugal-pump troubles and remedies.

Pumps, by F. A. Kristal and F. Annett. Cloth bound, 6 x 9 inches, 373 pages. Published by McGraw-Hill Book Company, 330 W. 42nd St., New York 36, N. Y. Price, $6.50.

AMERICAN POWER CONFERENCE PROCEEDINGS

The American Power Conference, successor to the Midwest Power Conference, is sponsored by the Illinois Institute of Technology with the cooperation of many universities and technical societies.

At the 1953 conference held in Chicago in March there were sessions devoted to mechanical and electrical problems, papers on hydro-electric power, water technology, and sessions devoted to heating and air conditioning. The latter had papers arranged in the following groups: Heating of modern homes; heat pump research and applications; residential air conditioning and residential and commercial heat pumps.

All the papers presented are now available in the proceedings of the fifteenth annual meeting.

Proceedings of the American Power Conference, 1953. Cloth bound, 6 x 9 inches, 959 pages. For sale by Illinois Institute of Technology, Technology Center, 3300 S. Federal St., Chicago 16, Ill. Price $6.

MEASUREMENT TECHNIQUES IN MECHANICAL ENGINES

A valuable guide to greater accuracy in machinery testing is found in Measurement Techniques in Mechanical Engines, by R. J. Sweeney, consulting engineer. The author has had extensive background in the field of laboratory and test work and in teaching mechanical engineering laboratory courses at Cornell and Lehigh.

The book was designed to aid the student and the practicing engineer in development and research work. An insight is presented into the principles on which instruments are designed and the difficulties involved in obtaining a correct measurement of physical quantities with the

(*Continued on page* 143)

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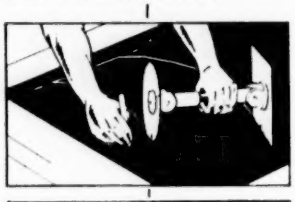

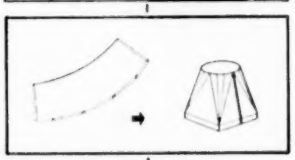

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(Continued from page 147)

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Divided into twelve chapters and an appendix, the subject matter covers mensuration, mass, time and speed, electrical measurements, dynamometers, pressure temperature, fluid flow, calorimetry, chemical analysis, and automatic controls.

Measurement Techniques in Mechanical Engineering, by R. J. Sweeney. Cloth bound, 6 x 9 inches, 309 pages. Published by John Wiley & Sons, Inc., 440 4th Ave., New York, N. Y. Price, $5.50.

• • •

SPRAY TYPE DISHWASHING MACHINES—Standard No. 3 of the National Sanitation Foundation covers spray-type dishwashing machines. Included are data on materials, construction and design, spray patterns of wash and rinse waters, and installation and operation. National Sanitation Foundation, Ann Arbor, Michigan. Price, 50 cents.

REVIEW OF CURRENT RESEARCH—The Executive Committee of the Engineering College Research Council, a unit of the American Society for Engineering Education, has issued its bi-annual report on the Review of Current Research and a Directory of Member Institutions. About $200 millions are being spent by colleges for research work and this paper bound book of 330 pages lists the various research projects now underway at the many colleges in this country. Approximately 7,500 research projects are reported and they cover all branches of engineering and most of the related fields. The next edition of this study may be published in 1955. V. E. Neilly, Secretary, Engineering College Research Council, 103 Mechanical Engineering, The Pennsylvania State College, State College, Pa. Price, $2.50.

PETROLEUM SAMPLNG—The second edition of the Manual on Measurement and Sampling of Petroleum and Petroleum Products contains the latest and most practical measurement practices in use today. It was prepared by a special division of ASTM Committee D-2 headed by L. C. Burroughs. All except one of the methods is presented in revised form. There are special instructions and precautions to be followed, and a large number of illustrations. This 150-page book can be obtained from the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. Price, $1.50.

SYMPOSIUM ON CONDITIONING AND WEATHERING—As part of the fifty-fifth annual meeting of the American Society for Testing Materials held in New York City last year, there was a symposium on conditioning and weathering. This A.S.T.M. special technical publication No. 133 contains papers that were presented as part of this symposium and covers among other things air conditioning in the manufacturing and testing of textiles, laboratory air conditioning, weathering of paper, adhesives and coatings. For this 104-page publication write to the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa. Price, $2.25.

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This diffusing type floor register was carefully engineered, in cooperation with heating specialists, to provide the answer for a perfect outlet for perimeter heat!

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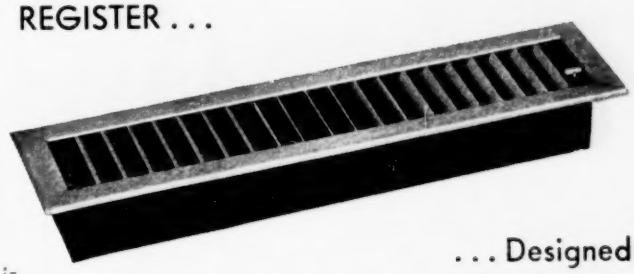

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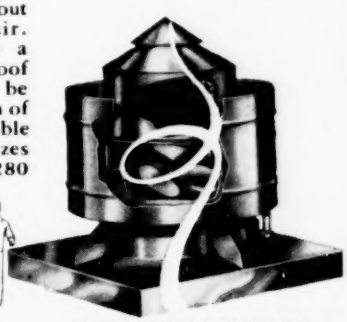
No problem too tough-whether your air is London Fog thick or Sahara Dry-gaseous or dusty- smoky or hot . . . MUCKLE VENTS remove it quickly and efficiently. These streamlined, propeller driven, roof mounted ventilators are designed with motor out of the air stream to effectively pull out either wet or dry air. MUCKLE VENTS are a completely weatherproof packaged unit ready to be installed with a minimum of expense and work, available in wide range of 15 sizes from 254 CFM to 10280 CFM.



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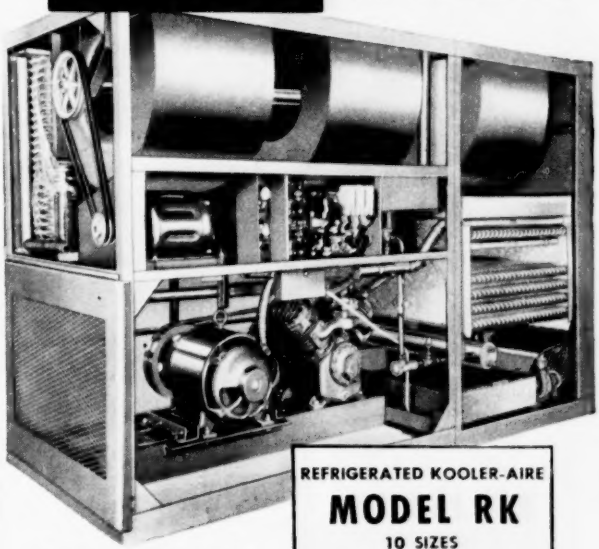

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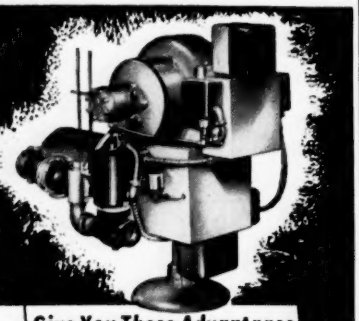

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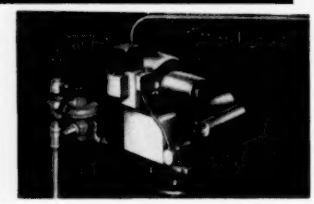
Boiler fired at 2,000,000 B.T.U. input—gas and oil installation in a large Midwestern paper distributing plant



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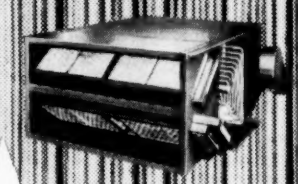
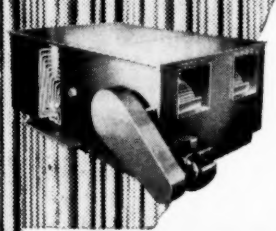
THE NEW MASSACHUSETTS AIR CONDITIONING UNITS





SEVEN SIZES . . . . . available, ranging from 1,000 to 14,000 C.F.M. Designed to combine cooling in summer, heating in winter.

Built in sections - Vertical or horizontal mounting. Various combinations and arrangements of discharge and by-pass damper.

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COMING EVENTS

Where listed, names or titles of individuals are those from whom further information is available.

PROFESSIONAL ENGINEERS MEETING—The seventh annual summer meeting of the Wisconsin Society of Professional Engineers, at Elkhart Lake, Wis. R. J. Mendenhall, W.S.P.E. program committee, A. O. Smith Corp., Milwaukee 1, Wis. ..... **SEPTEMBER 18-19, 1953**

INSTRUMENT EXHIBIT—6th National Instrument Conference and Exhibit of the Instrument Society of America, at the Sherman Hotel, Chicago, Ill. John McCaffery, assistant executive secretary of the Society, 1319 Allegheny Ave., Pittsburgh 33, Pa. ..... **SEPTEMBER 21-25, 1953.**

ELECTRICAL ENGINEERS CONFERENCE—Conference on the application of motors to the air moving industry, at the Hotel Van Orman, Ft. Wayne, Ind. Sponsored by the Fort Wayne section of the American Institute of Electrical Engineers, the conference will be held in conjunction with a symposium on induction motors. John Carroccio, publicity manager, 1813 East State Blvd , Fort Wayne 3, Ind. ..... **OCTOBER 6-8, 1953**

CORROSION ENGINEERS MEETING—Meeting of the South Central Region, National Association of Corrosion Engineers, at the Mayo Hotel, Tulsa, Okla. Executive secretary of the Association, 1061 M & M Bldg., Houston 2, Tex. ..... **OCTOBER 7-9, 1953.**

INDUSTRIAL HYDRAULICS CONFERENCE—Ninth annual National Conference on Industrial Hydraulics, sponsored by the Illinois Institute of Technology, at Sheraton Hotel, Chicago, Ill. Otmar E. Teichmann, conference director, Illinois Institute of Technology, Chicago 16, Ill. ..... **OCTOBER 8-9, 1953.**

WELDING MEETING—33rd annual meeting, American Welding Society, Hotel Cleveland, Cleveland, Ohio. M. M. Kelly, Secretary, 29 West 39 St., New York, N. Y. ..... **OCTOBER 19-23**

AGA CONFERENCE—Annual conference of the American Gas Association, at Kiel Auditorium, St. Louis, Mo. Secretary of the Association, 420 Lexington Ave., New York, N. Y. ..... **OCTOBER 26-28, 1953.**

CONTRACTORS CONVENTION—Annual convention of the Refrigeration & Air Conditioning Contractors Association, at the Carter Hotel, Cleveland, Ohio. Secretary of the Association, 228 N. LaSalle St., Chicago 1, Ill. . . . **NOVEMBER 8-11, 1953.**

ALL-INDUSTRY EXPOSITION—8th All-Industry Refrigeration & Air Conditioning Exposition, at the Public Auditorium, Cleveland, Ohio. Geo. E. Mills, show director, 1346 Connecticut Ave., Washington 6, D. C. ..... **NOVEMBER 9-12, 1953.**

PUBLIC HEALTH MEETING—81st annual meeting of the American Public Health Association and annual sessions of 40 related organizations, at the Hotels Statler and New Yorker, New York, N. Y. Dr. R. M. Atwater, executive secretary of the Association, 1790 Broadway, New York, N. Y. ..... **NOVEMBER 9-13, 1953**

ASRE CONVENTION—Annual convention of the American Society of Refrigerating Engineers, Shoreham Hotel, Washington, D. C. Secretary of the Association, M. C. Turpin, 40 W. 40th St., New York, N. Y. ..... **DECEMBER 6-8, 1953**

ASHVE MEETING—Annual meeting of the American Society of Heating and Ventilating Engineers, in Houston, Tex. A. V. Hutchinson, secretary of the Society, 62 Worth St., New York 13, N. Y. ..... **JANUARY, 1954**

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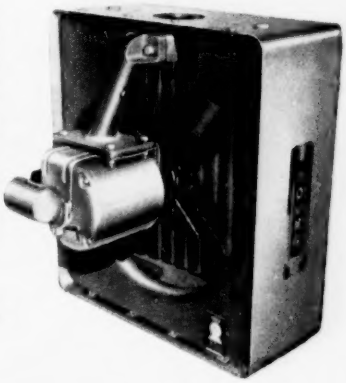

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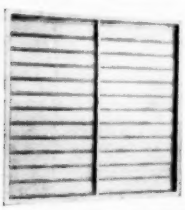

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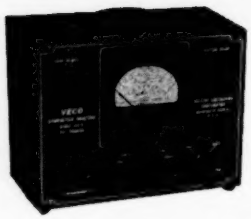

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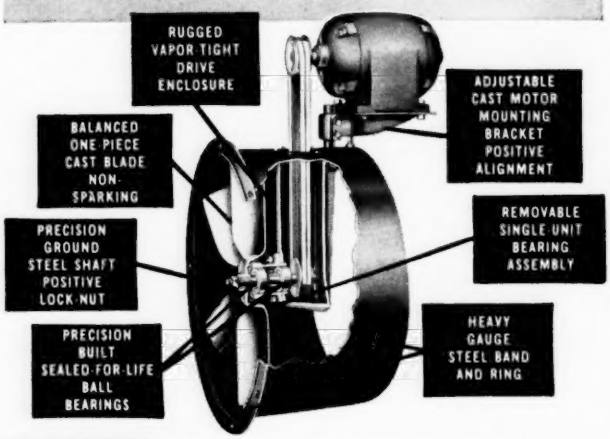
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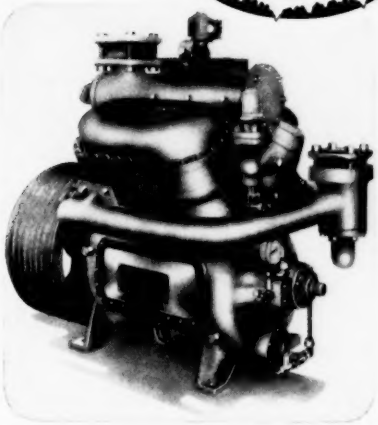

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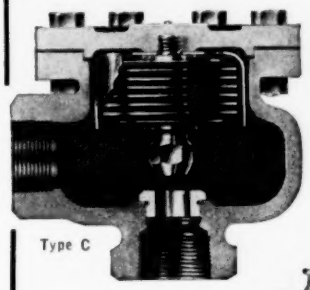

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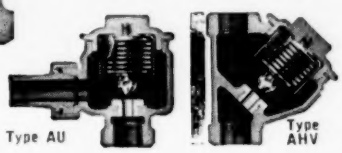

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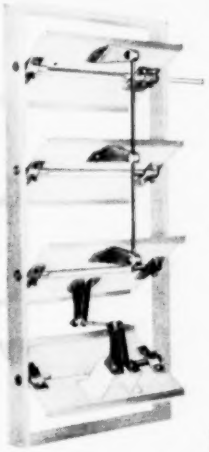

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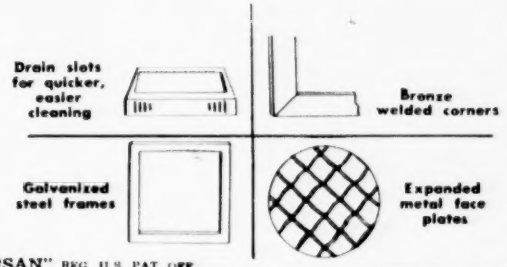

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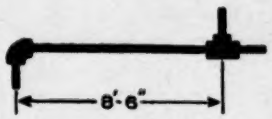
ESTIMATING LENGTH OF PIPE WITH CAST IRON FITTINGS

The accompanying tables for determining pipe lengths between screwed cast iron pipe fittings were prepared by Richard Irmiter. They are for use where reasonably accurate center-to-center measurements are desirable. Allowances for elbows, tees, and crosses (dimensions *A* and *B* in Table 1) are the same as for malleable iron fittings although the two types vary in dimensions and cross-section.

Dimensions given are based on commercially perfect pipe and fittings installed under ideal conditions. Therefore, the figures given should be regarded as close approximations, and individual users can determine from experience correction factors to be applied in individual cases.

Values in tables for dimensions *A*, *B*, *E*, *F*, *J*, and *K* are distances from the center-line of the fitting to the end of the pipe screwed into the fittings. In piping layout, the actual length of pipe between two fittings is the center-to-center distance between fittings less the tabulated value for each fitting.

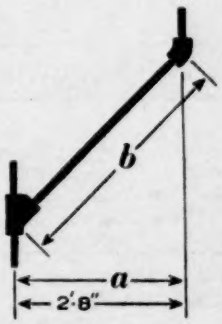
Example: The center-line distance between a tee and a 90-degree elbow in a 3-inch line is 8 ft 6 inches. According to Table 1, the distance to subtract for the elbow is 2⅛ inches. The same for the tee. The total distance to subtract is 4¼ inches, leaving an actual pipe length of 8 ft 1¾ inches.



Straight or sleeve couplings, unions, and street elbows are made in malleable iron only. Allowances for these fittings were previously presented.

To calculate the diagonal distance between two 45-degree fittings without the chart when the perpendicular distance between center-lines is known, multiply the known distance by 1.412. The fitting allowances are subtracted from the result to give the actual length of diagonal pipe.

Example: A vertical 2-inch pipe is to be offset 45 degrees using an elbow and a Y-bend. The horizontal distance (*a*) between center-lines must be 2 ft 8 inches (32 inches). The diagonal distance (*b*) between center-lines will be 32 x 1.412 = 45.244 inches or 3 ft 9¼ inches. The fitting allowance for the Y-bend from Table 1 is 3¾ inches, and for the elbow is 15/16 inch. The sum of the fitting allowances, 4 11/16 inches, is subtracted from the Diagonal distance between center-lines to give an actual diagonal pipe length between fittings of 3 ft 4 9/16 inches.



Thread engagements for cast iron pipe are the same as for malleable iron pipe. Thread engagement distance subtracted from the end-to-center-line dimension of any fitting or valve will give the amount to be subtracted from the pipe-line measurement in determining actual pipe length. Examples of this method, for fittings not shown in the tables, were presented with the malleable iron fitting data.

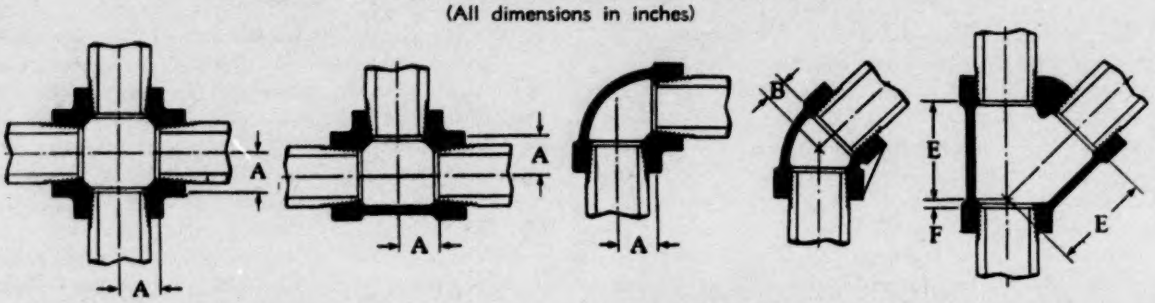
Although most fittings made in the U. S. are made up to the same standards, it may be found that there are variations from the figures shown in the tables when it comes to making up joints. It must also be kept in mind that the dimensions given in the tables are based on certain conditions—commercially perfect threads on both the fittings and pipe, proper thread lubrication, the correct amount of torque applied to the wrench, and non-slipping teeth on the wrench. Some thread compounds furnish better lubrication than others, which causes variations in the amounts that joints can be taken up. The distances that threads are cut on pipe also vary, depending on who cuts the threads. It is best to consider the pipe lengths calculated from the tables as close approximations, and to expect discrepancies of several threads too short or too long when making up a joint. The individual can determine after using the tables for a while just how much, in his particular case, to add or subtract from the tabular values for joints in order to achieve center-to-center distances agreeing with his calculations.

Clean, smooth pipe threads are essential to a good joint and depend largely upon the rake or lip angle and lead of the chasers, and the clearance, chip space and number of chasers in the die-head. The lip angle should vary from 15 to 25 degrees, depending upon the style and condition of the chasers and chaser holders. The chip space in front of the chasers should be large enough to allow room for accumulation of chips and at the same time provide means of lubricating the chasers. This is an important point, as insufficient chip space will cause the chips to clog and tear the threads. The lead of the chaser is the angle which is machined or ground on the leading or front side, to enable the die to start readily on the pipe, and also to distribute the work of cutting over a number of threads. To secure a good thread, the lead should cover the first three treads. As the heaviest cutting is done by this beveled part, it should have a slightly greater clearance angle than the rest of the threads on the chaser. When re-grinding chasers which have become dull on the lead, care should be taken to give each chaser the same length of lead, as otherwise the work will be unevenly distributed.

Pipe threading dies should be lubricated with a good quality of lard oil or crude cotton-seed oil, the lubricant being used in liberal quantities.

TABLE 1. DIMENSIONS OF SCREWED CAST IRON FITTINGS

(All dimensions in inches)



Dimension Symbol on Drawing Above	Pipe Diameter														
	¼	⅜	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8
	Dimension														
A	7/16	9/16	5/8	3/4	13/16	1 1/16	1 1/4	1 1/2	1 3/4	2 1/8	2 3/8	2 5/8	3 1/4	3 13/16	5 1/8
B	3/8	7/16	3/8	7/16	7/16	5/8	3/4	15/16	1	1 3/16	1 5/16	1 1/2	1 13/16	2 1/8	2 13/16
E	..	..	..	1 11/16	2 1/16	2 5/16	3 1/8	3 3/4	4 1/4	5 1/8	..	6 1/2	..	..	..
F	..	..	..	3/16	1/16	5/16	3/8	1/2	5/8	3/4	..	1	..	..	..
Close Nipple Length	7/8	1	1 1/8	1 3/8	1 1/2	1 5/8	1 3/4	2	2 1/2	2 5/8	2 3/4	2 7/8	3	3 1/8	..
Thread Engagement	3/8	3/8	1/2	5/16	11/16	11/16	11/16	3/4	15/16	1	1 1/16	1 1/8	1 1/4	1 5/16	..

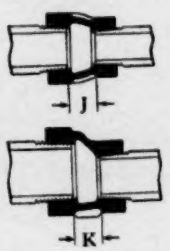
TABLE 2. DIMENSIONS OF SCREWED CAST IRON REDUCER COUPLINGS

(All dimensions in inches)

Large Pipe Diameter	¾	1		1¼		1½			2				2½			
Small Pipe Diameter	½	½	¾	¾	1	¾	1	1¼	¾	1	1¼	1½	1	1¼	1½	2
Dimension J	7/16	½	5/8	..	¾	..	..	..	..	1	1	1	..	..	..	15/16
Dimension K	..	..		7/8	¾	1	7/8	7/8	1 1/8	1	1	1	1 1/16	1 1/16	1 1/16	1

Large Diameter	3					3½						4					
Small Diameter	1	1¼	1½	2	2½	1	1¼	1½	2	2½	3	1	1¼	1½	2	2½	3	3½
Dimension J	..	..	..	1 1/8	15/16	..	..	..	..	..	..	..	..	..	1½	1 5/16	1¼	..
Dimension K	1¼	1¼	1¼	1 3/16	1	1 3/8	1 3/8	1 3/8	1 5/16	1 1/8	1 1/16	1 5/16	1 5/16	1 5/16	1½	1 5/16	1¼	1 3/16

Large Diameter	5					6						8	
Small Diameter	2	2½	3	3½	4	2	2½	3	3½	4	5	5	6
Dimension J	..	..	..	..	1½	..	..	..	..	1 13/16	1 13/16	..	2½
Dimension K	1 7/8	1 11/16	1 5/8	1 5/16	1½	2 5/16	2 1/8	2 1/16	2	1 13/16	1 13/16	2 5/16	2½



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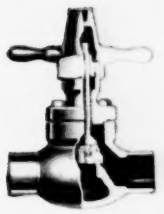
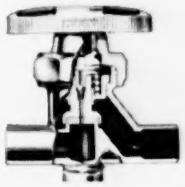


Wing Cap Valve

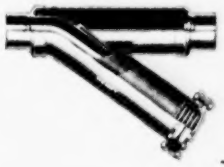
Packless Valve With Balanced-Action Blue Bantam Type



Packless Valve With Balanced-Action Standard Type

Drier

Ammonia Valve



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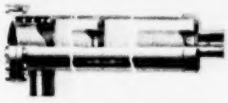

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743,400	230 1 Inch		30 lbs.	1"	1"
1,025,100	230 1½ Inch		30 lbs.	1½"	1½"
1,488,000	230 M-1	Includes 230 ¾ Inch	30 lbs.	¾"	2"
		230 M36	36 lbs.	1½"	
1,928,400	230 M-2	Includes 230 1 Inch	30 lbs.	1"	2"
		230 M36	36 lbs.	1½"	
2,150,400	230 M-3	Includes 230 1 Inch	30 lbs.	1"	2"
		230 M45	45 lbs.	1½"	

For Hot Water Tanks and Heaters

Opening Pressure	McDonnell Valve No.	Capacity Btu./hr.	Outlet (Female)	Inlet (Female)
75 lbs.	230-75	502,000	¾"	¾"
100 lbs.	230-100	640,000	¾"	¾"
125 lbs.	230-125	783,000	¾"	¾"
150 lbs.	230-150	925,000	¾"	¾"

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